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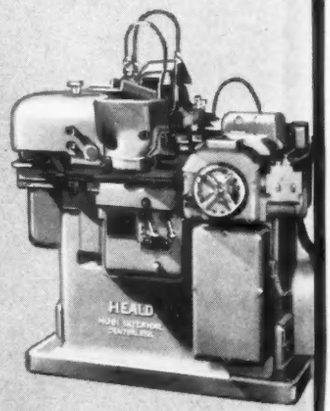

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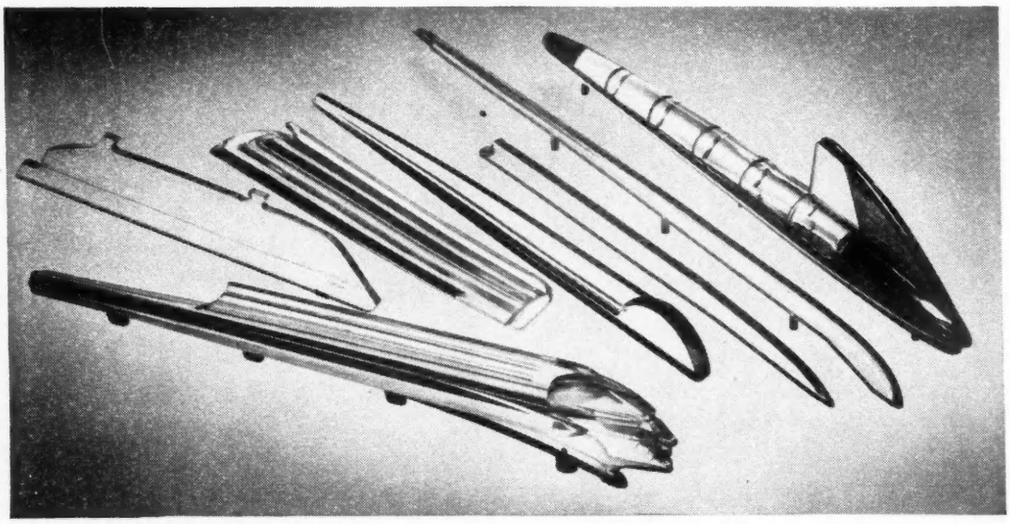

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AUTOMOTIVE INDUSTRIES

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Volume 84 February 15, 1941 Number 4

THE OUTPUT OF MANUFACTURING INDUSTRIES

THE OUTPUT OF MANUFACTURING INDUSTRIES, 1899-1937; *by Dr. Solomon Fabricant. Published by National Bureau of Economic Research, Inc., New York.*

As a part of a much larger project financed by the Falk Foundation, the National Bureau of Economic Research, Inc., has just published the first volume prepared by Dr. Solomon Fabricant on THE OUTPUT OF MANUFACTURING INDUSTRIES, 1899-1937.

Dr. Fabricant's new index, upon which he has been at work for several years, shows that during the 38-year period between 1899 and 1937 manufacturing output in this country increased by 276 per cent. The significance of the new index of production becomes apparent when the gain in output is compared with the increase in the country's population. Between 1899 and 1937, the population of the country increased from 75,000,000 to 129,000,000, or 73 per cent. Since manufacturing output increased by 276 per cent during these same years, Dr. Fabricant calculates that there was an increase of approximately 120 per cent in the manufactured goods available per capita. Because this figure makes no allowance for changes in the quality of the products, which have undoubtedly improved on the average, the rise of 120 per cent understates rather than overstates the per capita gain in factory-made goods.

Concerned primarily with long-term rather than cyclical changes, the author devotes considerable attention to the most recent period, 1929-37. In these troubled years, he finds, the output of manufacturing continued to rise, but at a much slower rate than in the preceding three decades. The increase in total factory output was three per cent in 1929-37, whereas the gain in population was six per cent.

Marked divergence is noted in the growth of individual industries. An outstanding illustration of disparity in trends is to be found in the transportation equipment group. Although this group as a whole made enormous gains, most industries manufacturing transportation equipment lost ground. The notable exception was, of course, the automobile industry, whose output in 1937 was 1800 times greater than that of 1899—sufficiently greater, indeed, to overbalance the losses in such industries as carriages and wagons, railroad equipment and shipbuilding.

In discussing individual manufacturing industries, Dr. Fabricant notes that "those manufacturing industries, which have forged ahead of others in production, are usually the ones in which prices have been cut in relation to the average for all manufacturing. On the other hand, increases in these prices, relative to the average, are commonly found in the laggard industries. There is evidence here that reductions in price have made possible gains in output; and, in turn, that gains in output, perhaps by fostering larger scale production, have promoted reductions in costs and thereby in prices."

AERO DESIGN

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The Making of Reduction Gears for Wright Aircraft Engines **151**

The stepping up of the aircraft industry to meet defense requirements has presented new techniques and procedures. How the new order of production is being met in building the Wright engines is told in revealing detail in this article.

Development of the Radial Engine for Military Uses **157**

Since the inception of this type of powerplant in 1888 there have been many developments. The original of Forrest or even the later model of Manley in 1901 are a far cry from present-day production. Here is an article on the development of today's radial engine designs started from the beginning. It covers a lot of ground in a few pages.

GM Allison Division Zooms to Action **162**

A great deal of public and engineering interest is centered on the Allison engine. Here is shown in picture and text some of the interesting operations that go into the production of this powerplant in quantity and on schedule.

MARINE ENGINES

Packard Powers the Mosquito Fleet **168**

During the first World War Packard distinguished itself in building Liberty engines. Again they come to the front with powerplants for the U. S. Navy's fastest craft. These boats are capable of speeds in excess of 50 m.p.h. With enlightening pictures and revealing text the story is told.

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Vol. 84, No. 4
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The Making of Reduction Gears for Wright Aircraft Engines

How Precision is Maintained in Quantity Production

By LESLIE PEAT

AMERICA'S present defense program, insofar as aircraft engines are concerned, provides necessarily for tool-room precision on mass production schedules. Regulations imposed by the government upon contract manufacturers forbid disclosures of production quantities, but examples of the success in manufacturing the millions of engine parts needed in our national defense program are an inspiration to all of us who hope; there is comfort here for those of us who have doubted.

Each component part of an aircraft engine must be strong enough to withstand stresses far beyond those allowed for in motor-vehicle design, yet each part must be as light in weight as aeronautical design and production ingenuity can make it. A good example of highly-stressed units is the planetary reduction gear of the Wright Cyclone aircraft engine. One of these units is built up of a sun gear, six pinions, and a drive gear. A newer design of this gear set has 20 pinions.

Forged steel blanks of Nitralloy "G" are used for the sun and driving gear of the Cyclone propeller reduction unit. The six pinion gears are forged from SAE 3312, a nickel chromium alloy, or SAE 4620, a molybdenum steel.

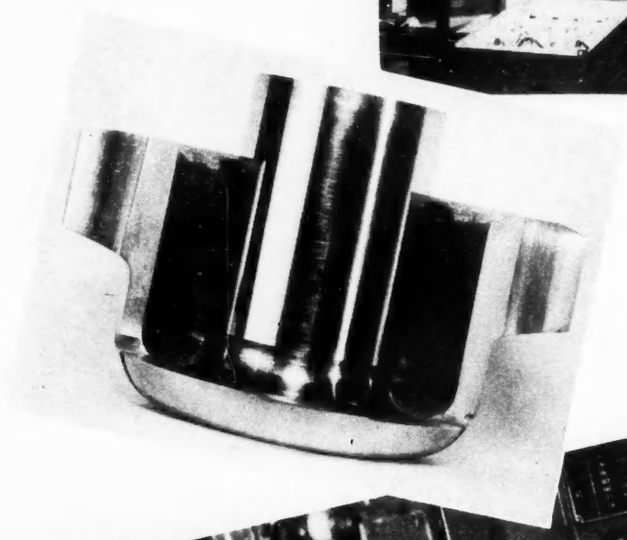
All locating surfaces are ground to assure accurate positioning on the gear shapers. Teeth must be cut to fairly constant thickness and concentricity, because heat-treatment develops distortion, run-out, and changes which cannot be controlled with any degree of precision. Gear chucks are used in holding gears while being machined for locating surfaces after hardening.

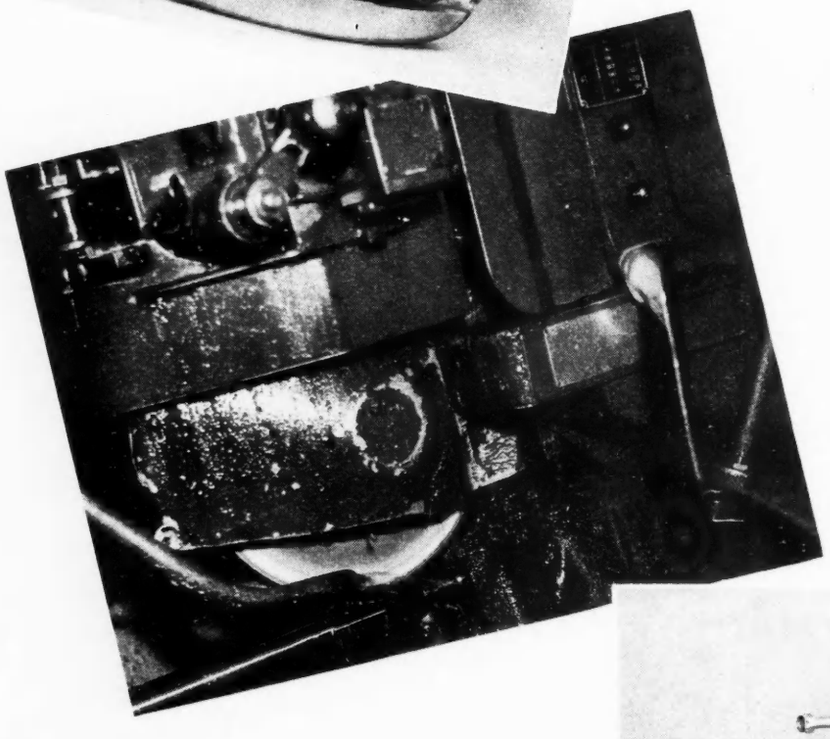
The outside diameter of the finished pinion gear is 3¾ in., and the teeth are 15/16 in. wide. The pressure angle is 20 deg. There are 18 teeth of 5.4 diametral pitch.

After preliminary machining, the pinions are full copper plated to a depth of about 0.0004 in. for selective carburization. Teeth are cut on Barber-Coleman gear hobbers, of which there are about 20 in the Paterson, N. J., plant of the company. Here the copper plating on all tooth surfaces is removed, permitting the metal to take the carburization. The pinions are hardened to Rockwell C-60 on the case, and to C-32 to C-40 in the core. The depth of the case is 0.025 in. to 0.035 in. Wherever possible, carburized gears are quenched

(Below) Cross-section of one of the six pinions in the propeller reduction gear of the Wright engine. The pinion is designed in this way to permit a slight spring action of the teeth against the mating gear.

Some of the 100-odd Fellows gear shapers at work in the Wright plant at Paterson, N. J.

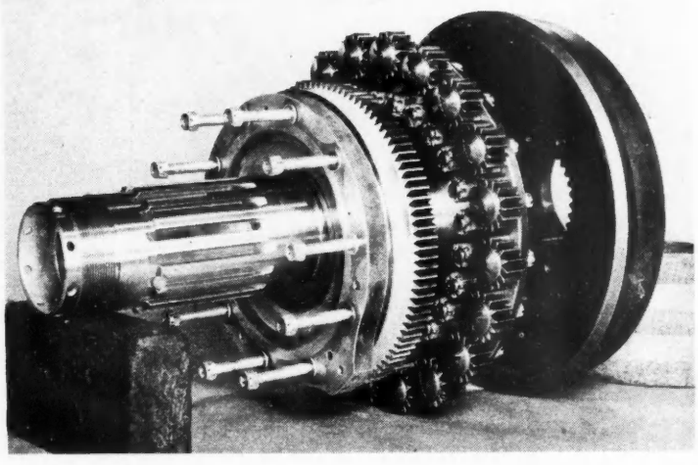




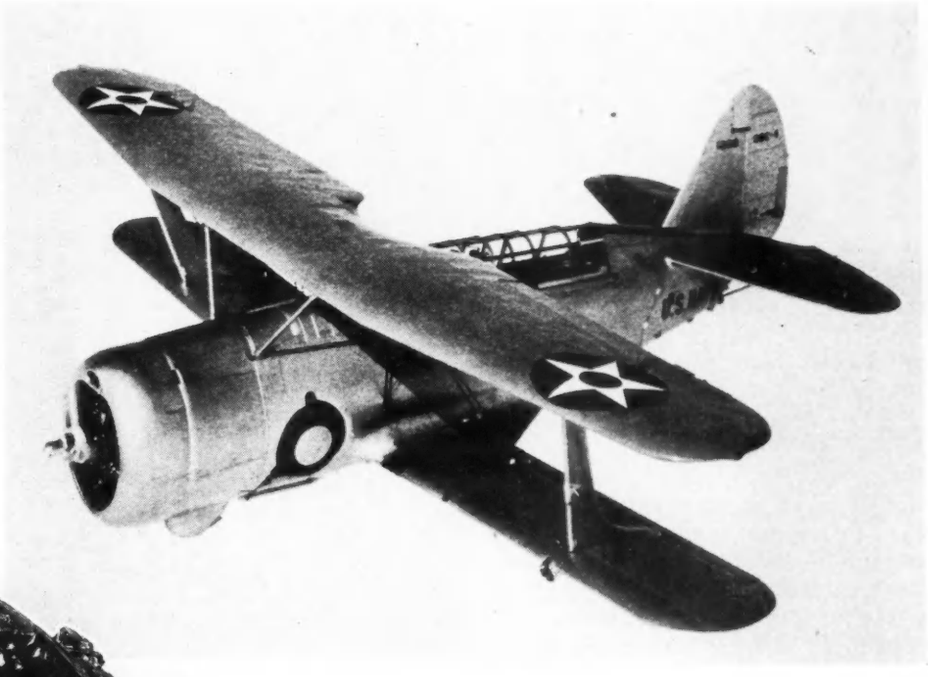
in dies. The sides, shank, and bore of the pinion are still protected by copper plate.

The sun and driving gears, when hardened, must have a Rockwell hardness of from C-66 to C-68, or a Vickers (Firth-Diamond) of about 1000, that is, they must be hard enough to cut glass. These blanks are forged by the supplier, under rigid chemical and physical controls, to exacting specifications. Grain flow of the gear blanks is carefully controlled, and a sample from every heat is checked microscopically in the Wright laboratory. This sample is cut in two, ground, and polished with aluminum oxide on a soft flannel wheel. Then an imported abrasive is used to give the cross section a mirror finish. It is then examined under a powerful microscope to check the grain control exercised by the supplier. Later, during the manufacturing process, when-

(Above) The setup for grinding a small pinion gear under oil coolant and at a wheel speed of about 6,000 ft. per min. This is a Pratt & Whitney gear grinder, of which there are about 20 in the plant.

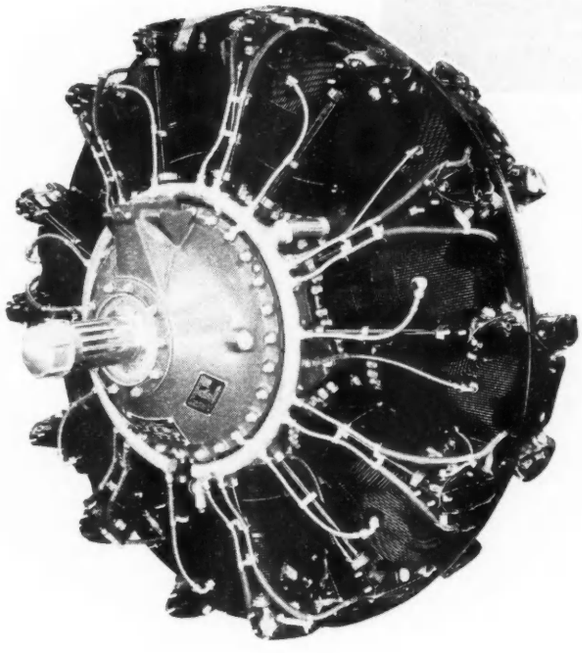


(Right) Wright 16:7 and 16:9 interchangeable spur-planetary reduction gear. An earlier designed model has only six pinions and a 16:11 ratio.



Curtis SBC-4 built for the U. S. Navy is powered by a Wright-Cyclone engine.

The Wright Cyclone 14 engine shown below generates 1600 to 1700 hp.

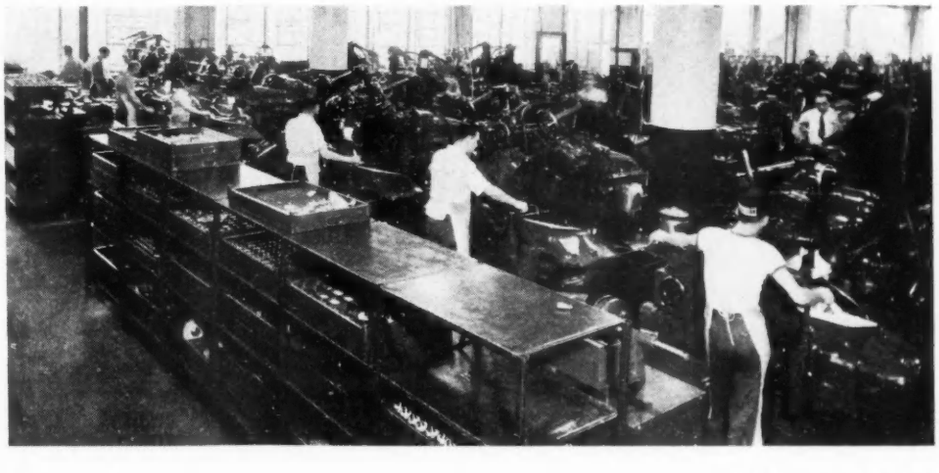


ever a blank causes trouble in machining or grinding, it is immediately cut at the point of failure, polished, and microphotographed in the laboratory.

Something like 60 per cent of the metal of the pinion blank is cut away on Potter & Johnson automatic turret lathes, to prepare the blank for the gear shapers. About 77 per cent of the metal of the sun gear blank is removed, and 67 per cent of the driving gear is cut away.

Gear teeth are cut on Fellows gear shapers to within about 0.008 in. of their final dimensions. The Wright plant at Paterson has about 100 of these machines—indicating the magnitude of the tooling program that has been under way at the plant for several years.

After the pinions have been hobbed and hardened, they are ground on Pratt & Whitney gear grinders, where five or six roughing cuts of about 0.0015 in. each are taken. At the end of each stroke the gear is indexed. The finish stroke takes off about 0.0005 in. Sizes are predetermined by the setting of the dial, which in turn actuates the wheel position. After the gear has made one complete revolution, a ratchet control automatically stops the table in the starting position, and the wheels are moved downward and dressed. The Pratt & Whitney machines are equipped with three wheel-dressing diamonds for each cutting wheel. These are all actuated by a single crank. The cutting face, clearance side, and diameter are all dressed by these diamonds. This is especially important when the



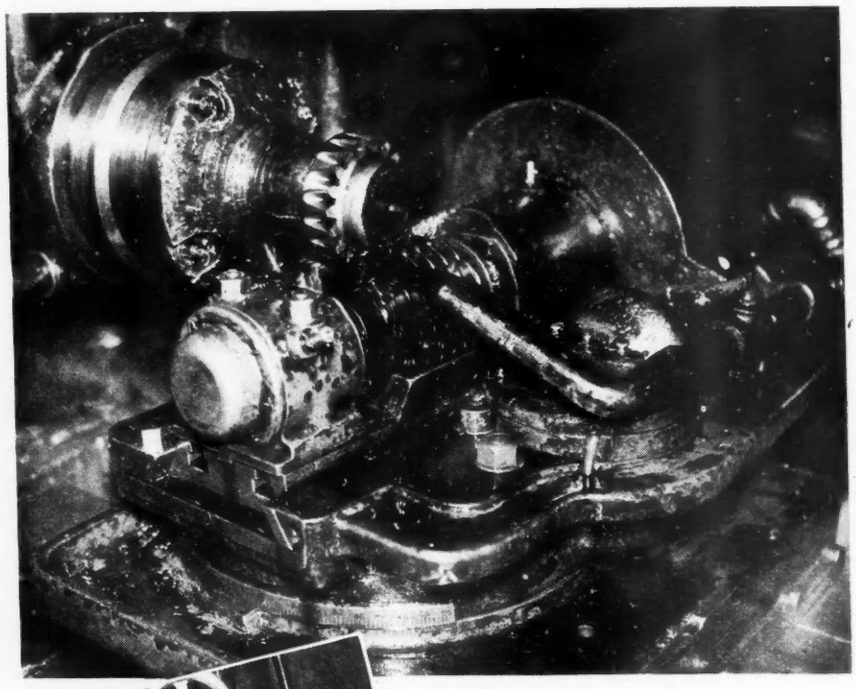
A general view of part of one of the Wright machine shops where spur gears are being ground.

root fillet radius is to be ground, as the wheels are always in the same plane and are of constant thickness.

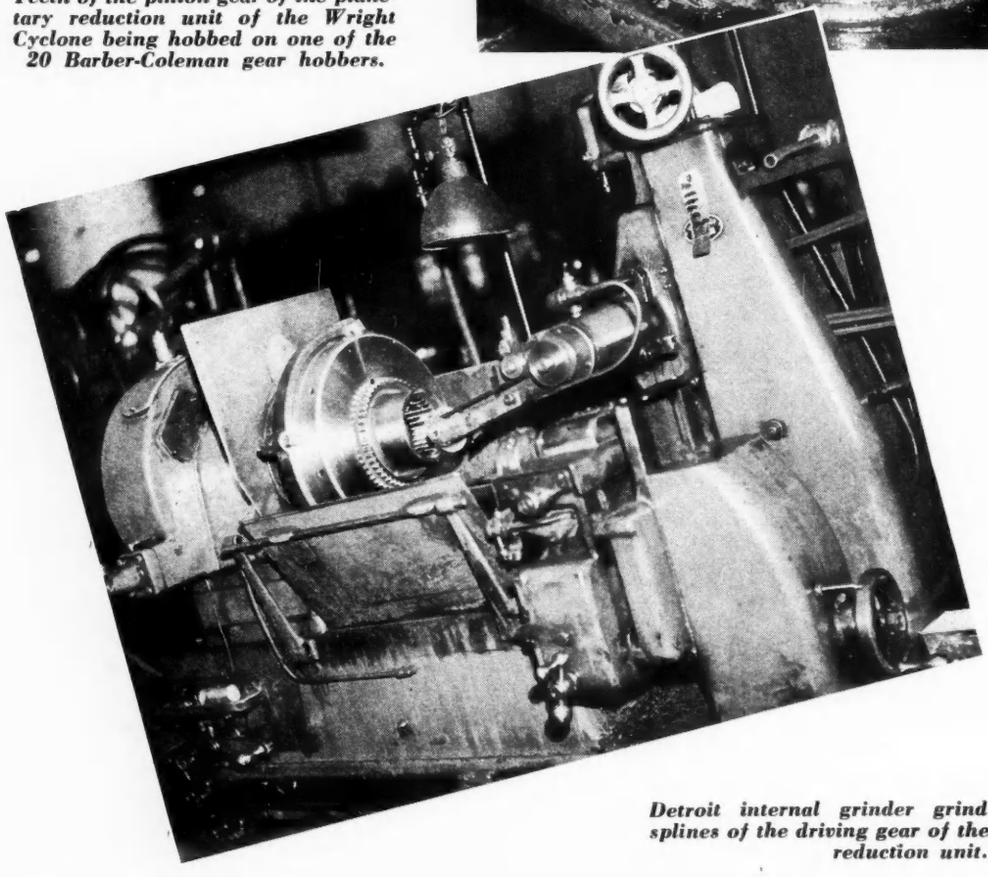
Carburized gears are finish-ground after hardening, and Nitralloy gears are semi-finish ground before hardening and finish ground after nitriding. This is due to the fact that the best section of the Nitralloy case is found at about 0.003 from the top surface. In the semi-finish grinding operation, the tooth is ground to within 0.004 to 0.005 in. of the finished tooth thickness.

Pinions require 53 operations in the Wright plant. Twenty teeth per minute is the average rate of production in grinding.

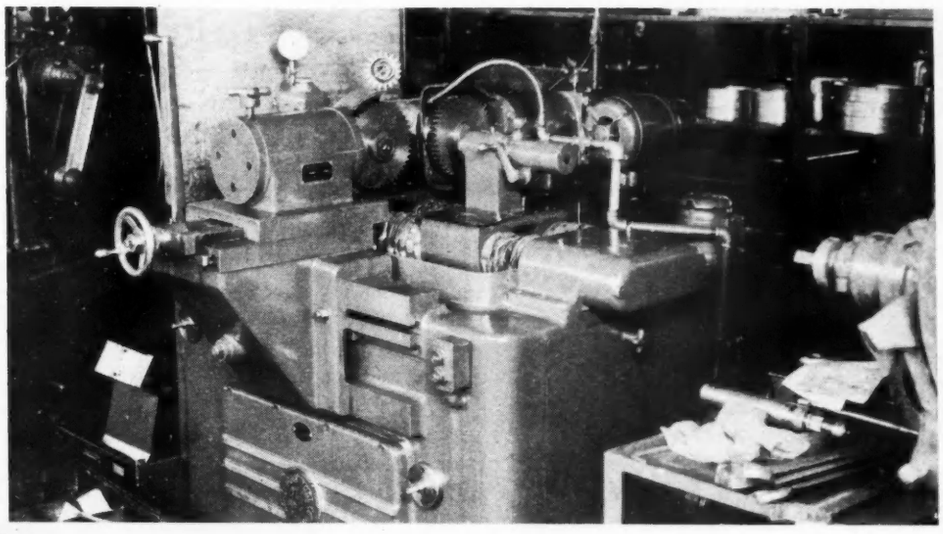
Grinding oil at this plant has been found preferable to water compounds for both gear and thread grinding. Oil, not having the quenching effect of water coolants, does not subject the gear-tooth surfaces to grinding checks, which, of course, would cause the part to be rejected without more ado. Oil keeps the wheel more free-cutting, and tends to prevent wheel glazing. Current Wright practice is to use either 3850 I or J, 6 BE, a Norton wheel of the saucer type. Wheel speeds are set at about 6000 ft. per min. This type of wheel breaks down slightly at the edges, to conform to the special fillet radius designed into the Wright propeller reduction gears. This modified tooth root was developed, and the grinding practice was adopted, to eliminate fatigue failures. This detail is an indication of the great effort required to make each part as strong as possible without resorting to added weight. Fatigue failures of gear teeth of the conventional form led to the adoption of this rounded fillet, and every part of the gears shows how careful the design and production engineers have been to eliminate all points of stress concentration. For example, all corners of the tooth profile are rounded. Long- and short-addendum teeth are used to give the required tooth contact or overlap, and the teeth are proportioned to equalize the load-carrying factors of the mating gears. Small pitches and correspondingly larger number of teeth are favored.



(Right)
Teeth of the pinion gear of the planetary reduction unit of the Wright Cyclone being hobbed on one of the 20 Barber-Coleman gear hobbers.

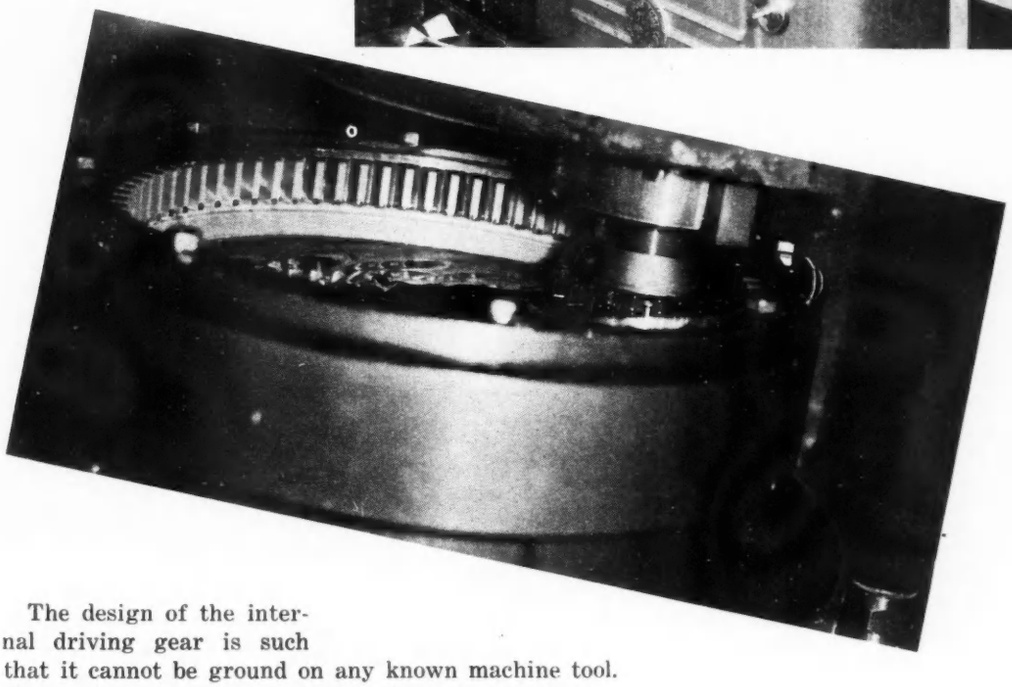


Detroit internal grinder grinding the internal splines of the driving gear of the Wright planetary reduction unit.



One of the Michigan Tool Co. grinders at the Wright plant. A finished pinion gear has been set up on the guard of the machine.

(Below)
One of the 61 manufacturing operations required by the reduction driving gear of the Wright Cyclone being cut on a Fellows gear shaper. There are several of this type of machine in the company's Paterson plant.



The design of the internal driving gear is such that it cannot be ground on any known machine tool. This unit requires 61 manufacturing operations.

The sun gear, or stationary member of the Wright planetary reduction system, requires 70 operations. It is ground for positioning, cut on a gear shaper, nitrided, and lapped. Its shape prevents grinding.

About 60 per cent of the Wright Cyclone engine gears (of which there are about 25) are ground. Some of the gears are spiral-bevel and others are straight bevel, which cannot be finished by grinding. Lapping, of course, is used only to remove the grinding fuzz, minute wheel marks, etc., as excessive lapping would modify the tooth form. Several different types of gear lappers are used, depending upon the design of the gear being finished. Cast iron laps, cut in the Wright tool rooms, are used exclusively for this operation.

Involute splines are used extensively on the Wright engines. Here as in gears, it is necessary to produce the greatest possible area of bearing surface, in order to keep every part of the engine as light as today's design and manufacturing techniques can make them. The greater the percentage of effective bearing surface, the greater the load-carrying capacity of the spline. Form grinding is employed in producing these splines, as well as in producing internal gears, pump gears, and other gears so designed as not to permit the use of a grinding wheel of large diameter. The Gear Grinding Machine Company's equipment is used for this type of work.

To secure the required fits, many Wright splines are held to tolerances as close as 0.0004 in. on the chordal thickness, and 0.0002 in. on the involute form. Wheels for this work are dressed with the special radius-dressing attachment used to grind the fillet radius.

Illinois, Fellows, and Vinco involute-checking machines are used. The Illinois and Fellows produce a graphic chart which is kept as a permanent record. This serves the dual purpose of checking subsequent inspections, and to verify the accuracy of any given setup of grinding machines.

A checkup is made of every setup. Spot checks are then made periodically to insure accurate dimensions of the gears in production. Magnetic inspection of gears—a standard practice—showed the need for using grinding oil instead of water coolant, besides performing the parts inspection function. This routine showed distinctly minute grinding cracks. As a result of this disclosure, and of switching to oil, losses due to grinding-check rejections have been practically eliminated.

In cases of gears of well-supported design, the tolerances on tooth profile and normal pitch are held to 0.0002 in. or 0.0003 in., while that on concentricity is of the order of 0.0005 in.

Because of the special requirements to be met, grind-

(*Turn to page* 190, *please*)

Development of the Radial E

By HENRY L. BROWNBACK

THE RADIAL engine is playing a role of primary importance in the national defense program, being employed as it is, not only in aircraft, but also in tanks. For these purposes we are making it in both gasoline and Diesel types.

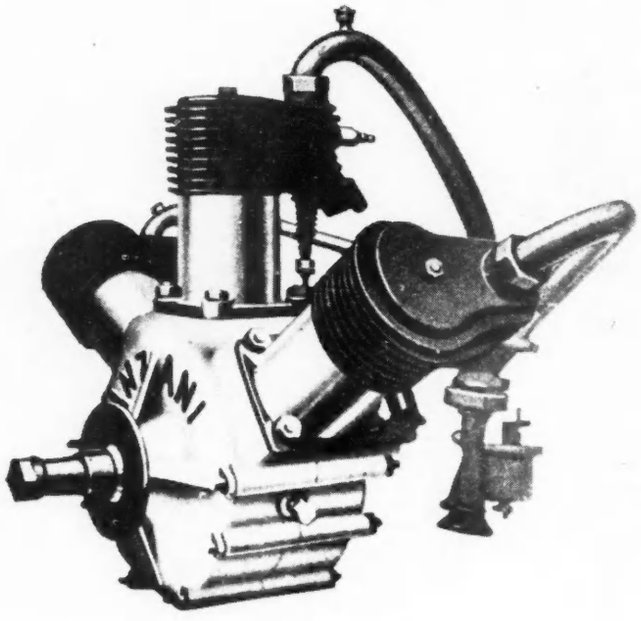
The radial arrangement of cylinders represents the most economical use of material, and a radial engine, therefore, is very light and should be cheap to build. It has only one crank throw for from three to nine cylinders, depending on the type of engine and the design of the connecting-rod assembly. Even the lightest of these engines have completely counter-balanced crankshafts—often with a built-in torsional damper.

While some large engines of the radial type have been built for industrial installation, and in Europe small engines of this design have been installed in motor cars, the majority of radials have been used in aircraft. Most of the world's large commercial planes, long-distance bombing planes and large seaplanes, as well as the majority of American large airplanes are powered with this type of engine.

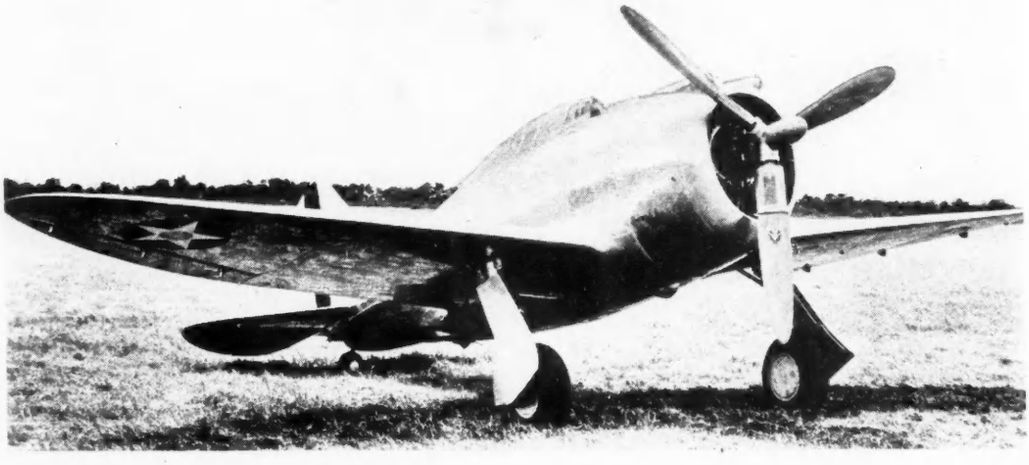
The first radial engine of record was built by Forest in 1888, and the first successful light airplane engine was built by Charles M. Manley for Dr. Langley in 1901. This five-cylinder engine developed 52.4 hp. and weighed only 2.36 lb. per hp., as compared with 10 lb. per hp. for the early Wright engines.

Inasmuch as we have not the space here to discuss the rotary radial engine, which played an important part in early aviation and until the end of the World War, let me point out that an American, Farwell, built the first engine of this type in 1896 and some were installed in Adams-Farwell cars as early as 1903.

While the early development of the radial engine was American, the type really got its industrial start in Europe. When Bleriot designed his early monoplanes he felt the need for a light air-cooled engine of about 20 hp. and went to a French motorcycle builder, Buchet, for advice. Here the problem was



The original three-cylinder Anzani engine



This pursuit YP-43 monoplane is powered with a Pratt & Whitney engine. It weighs about 6900 lb. with a wing spread of 36 feet

Engine for Military Uses

Curtiss-Wright interceptor plane can climb over a vertical mile in 60 seconds. It is equipped with four machine guns and has a horizontal speed of 330 miles per hour

turned over to a mechanic named Anzani, who was building motor cycle engines for Buchet. At the time Bleriot came to see Buchet, Anzani was greasing a twin cylinder, wide-angled racing engine which he had just built, and put the grease can on the crankcase between the cylinders while he talked. When the problem had been explained and he was trying to puzzle out some way of getting the desired power out of an air-cooled engine, he turned his head and saw the can and the cylinders and immediately thought of a three-cylinder "fan" engine. Bleriot was impressed, but Buchet was not, so Anzani started out for himself, and in 1908 built the engine. This powerplant was used in the famous cross-channel flight of 1909 which made both Bleriot and Anzani famous.

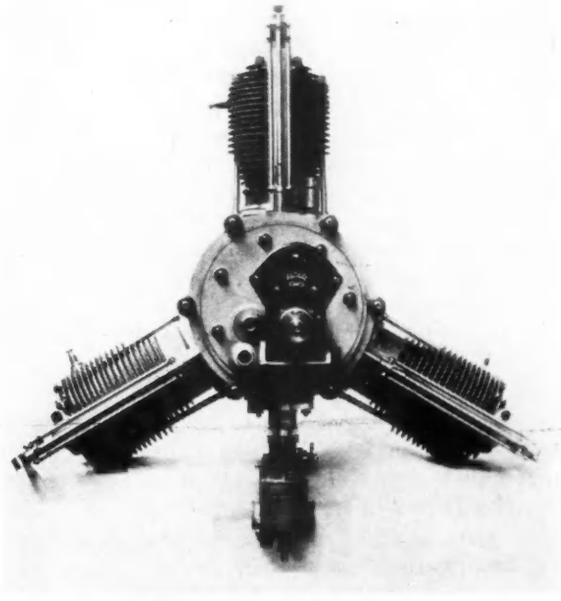
In 1910 Anzani changed his design to a three-cylinder Y engine which was used probably in more different types of airplanes in more countries in the world than any other engine during its long history, 1910-1929. Anzani also built five, six, ten, and 20 cylinder radial air-cooled engines of from 25 to 220 hp.

During the World War the British became most active in the designing and development of large air-cooled radials, following the success of the French radial water-cooled Salmson engine which powered so many World War planes, and when the Armistice was signed, they had several models ready for production. After the war the United States Navy took a leading part in the development of the radial engine and commissioned the Wright company, which was building Hispano-Suiza engines under license, to build the nine-cylinder Lawrance engine which had shown great possibilities. Mr. Lawrance joined the Wright company as president, and the engine was produced as the "Wright." These engines made history, and a short time later, George Mead, who had been most active in the development of the engine, left the Wright company and went to Pratt & Whitney to start their long line of famous engines.

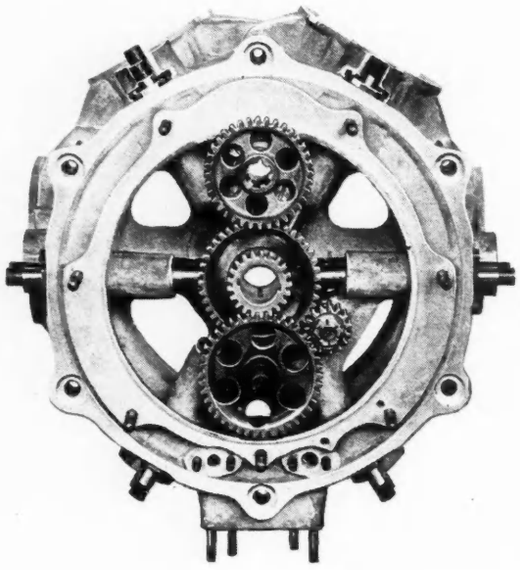
In Europe the Bristol company produced its famous Jupiter engine, which was built under license in almost every country in the world, and the air-cooled radial engine became the leading aircraft powerplant.

The radial engine, so successful in aviation, has had practically no automotive success. There are several reasons for this, and we shall go into them one by one and show how modern design and manufacturing methods may be used to produce these engines for automotive work.

From the beginning, and up to the present time, the radial engine has been under the same disadvantage as other types were before foundry technique permitted the cylinder block and the crankcase to be cast together, thus making a light and rigid assembly which could be manufactured cheaply and did not require a multiplicity of heavy parts which had to be machined separately at high cost and then bolted together.



Anzani Y-type three-cylinder engine, in production from 1910 to 1929



A simple timing-gear train for a radial engine

The second disadvantage of the radial engine has been a very costly connecting rod construction that is extremely heavy at the crankpin end, thus limiting rotative speeds.

A third disadvantage has been that cylinder and head were a permanent assembly and it was necessary to take off complete cylinder assemblies in order to inspect and grind valves.

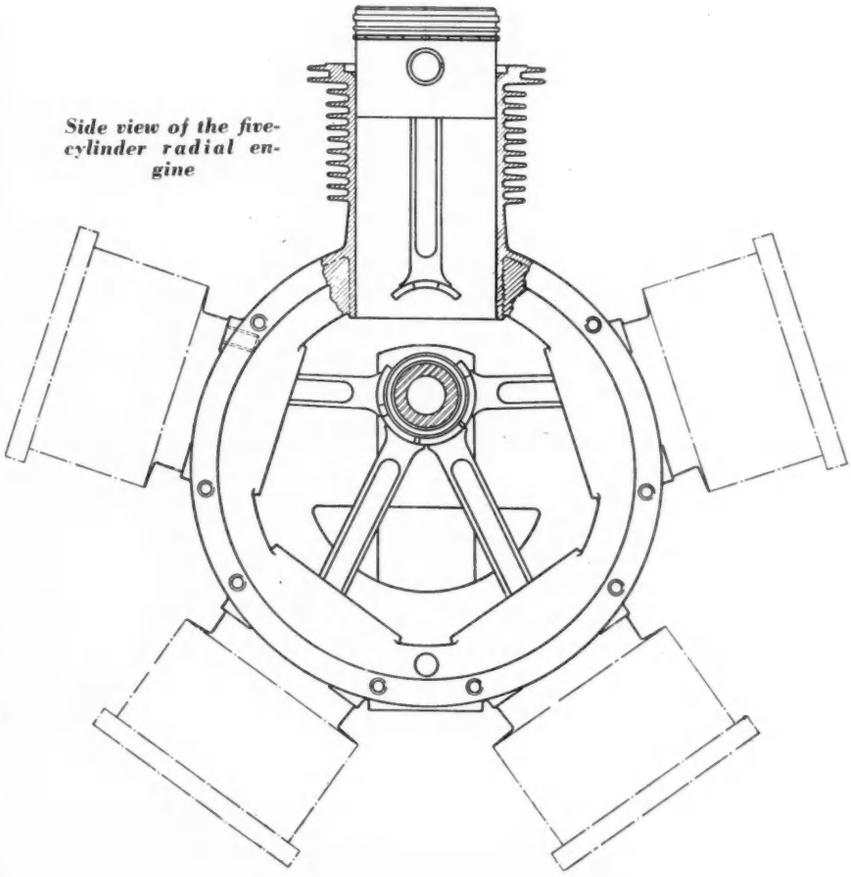
As regards motor cars and trucks, the radial design did not lend itself to front-end installations on vehicles with rear-end drive. In 1927 it was suggested to Anzani—who was then making many engines for the American market—that he should seriously consider the possibility of an engine having the cylinders and the center section of the crankcase all cast in one piece, using detachable cylinder heads and assemblying the connecting rods through the large openings left when the end plates were removed. Such an engine would be light, very stiff, and very simple and cheap to manufacture and maintain. Anzani refused to consider the proposition, as no block castings of this type had been tried, and he was not convinced that the detachable cylinder head would work out.

In 1928 the Brownback Motor Laboratories began the design of an aircraft engine in which it was hoped to be able to embody all of these ideas. However, the reluctance of foundries to attempt to make the block casting and the necessity of getting the engine on the market for the 1929 trade forced abandonment of the block-cylinder project but the other factors necessary for a one-piece engine were designed into the new engine and tried out. The "C400," as the engine was called, passed its government tests easily and achieved success under that name and as the Light Tiger, in many airplanes and in dirigible balloons. Many of the cylinder assemblies were used as replacements on existing Anzani engines and in the manufacture of the three-cylinder Jacobs engine. Thus it was proved that the detachable cylinder head was practical on air-cooled engines of this size.

As the connecting rods and pistons of the en bloc radial engine would have to be assembled by passing them through the cylinder bores from the top, the use of the usual master and articulated connecting rod assembly is impossible, except where the cylinder bore is very large and the stroke very short; in fact, the ratio must be almost 2-1. So we are forced to consider either a built-up master rod or some other type of rod assembly. Manly used a slipper rod, and the long line of very successful Anzani engines also used slipper rods, so these rods were used as the basis for the C400 design. In the Anzani assembly, three or five slipper rods were assembled on the outside of a split babbitt-lined bronze bearing and held in place by split bronze collars which formed their external bearing.

It must be noted here that while as many as ten cylinders may be assembled to one master rod in the usual type of construction, space limits the slipper rod to five cylinders per bearing when the slippers work directly on the exterior of the bearing. In some of the leRhone radial rotaries as many as nine cylinders worked

Side view of the five-cylinder radial engine

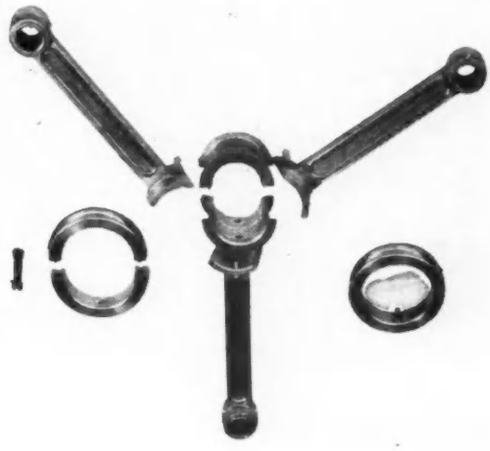


on one bearing, but the rod design was most complicated and costly. The Anzani bearing and collars floated, and all wear in the slippers, bearing and collars tended to allow the halves of the bearing to separate. This resulted in excessive oil consumption and in severe bearing pounding.

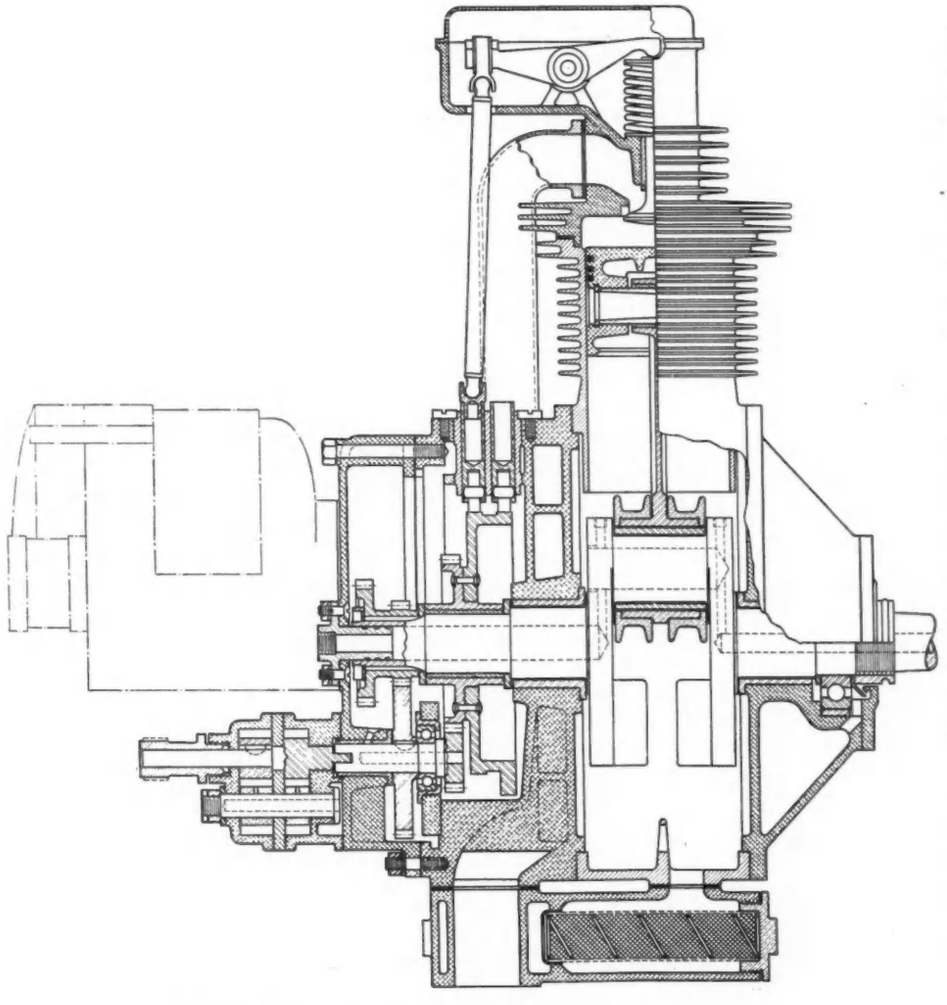
In the C400 the bearing was split but had flanges finished to the inside diameter of the collars, so that the halves of the bearing were held firmly together. In some types one rod acted as a master, being dowelled to the bearing and the collars. In this type, oil holes never uncovered by the slippers, provided pressure lubrication for the slippers and the collars. Potez in France makes a slipper-rod assembly in which the crankshaft is built up and solid "dural" bearings and collars are used with a nitrided crankshaft and nitrided connecting-rod slippers.

Both of these constructions have produced assemblies which have run for hundreds of hours with no trouble, and which are not only cheap to manufacture but which require no fitting whatever when repairs are made, as the worn parts are replaced by standard parts made to definite tolerances in order to give definite running clearances.

While the master and articulated rod assembly gives an uneven motion to the pistons, due to the fact that only the center of the master rod passes through the center of the crankpin, the motions and the strokes of all pistons in the slipper rod assembly are the same, as the centers of all of the rods pass through the center of the crankpin.



Parts which make up the slipper-rod assembly

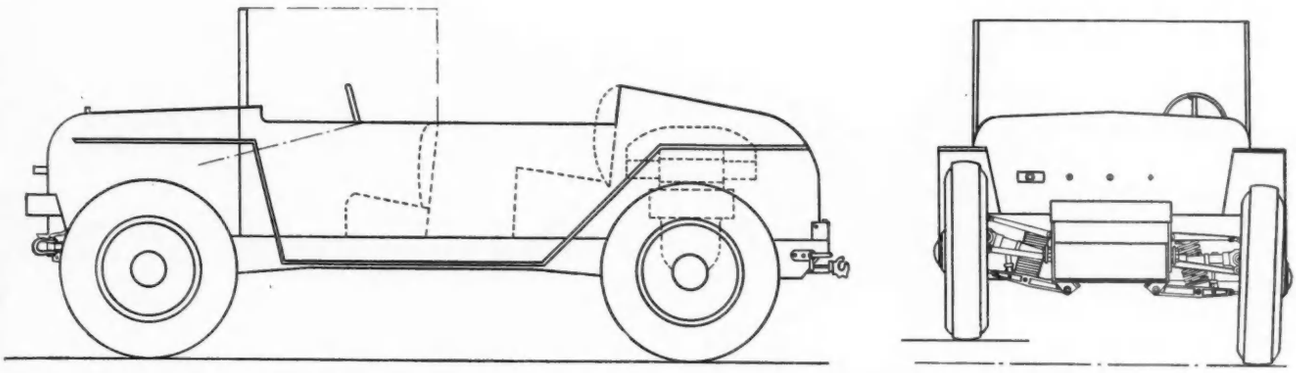


Longitudinal section of an en bloc five cylinder radial

Further, the big end and the rotating portion of the articulated rods of the master-and-articulated-rod assembly is very heavy and causes heavy centrifugal loads on the connecting-rod bearings at high rotative speeds; the concentrated weight of the slipper-rod assembly is much less and permits higher rotative speeds.

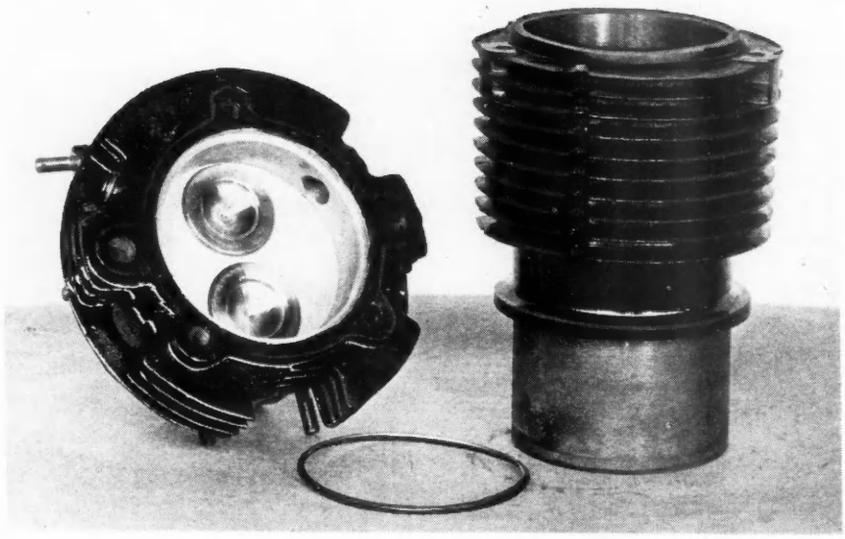
With the slipper-rod construction, the engines have to be built in multiples of three or five cylinders. A five-cylinder radial engine has very good torque characteristics and a ten-cylinder is "velvety." In fact, many of our present high-powered radial aircraft engines are built in multiples of seven or nine cylinders, and it is rumored that some multiple-row engines of extremely high power are in the offing. It has now been found perfectly practicable to cast radial air-cooled cylinders and a crankcase center, strongly webbed and very light, in either aluminum alloy (which would be fitted with a nitrided sleeve) or in iron.

The combination of these



Proposed scout car in which the radial engine, clutch, transmission and rear differential housing form a unit

proven features will solve the problem of producing both air- and water-cooled radial engines very cheaply, for both aircraft and automotive use, and for a given weight engines thus built can be made far stiffer and sturdier than the bolted-together engines now produced, except in the case of some very large light-weight airplane engines. The radial engine has never been seriously considered as a competitor for the present type in cars and trucks because of its complication and cost, and because it did not fit into present designs. However, the increasing use of rear-engined, rear-drive vehicles changes the picture considerably, as the radial engine combined with a fluid drive or a fluid flywheel and some sort of automatic or semi-automatic transmission would be most interesting from a weight standpoint. For a given horsepower the engine would weigh less than one-half as much as present powerplants.



Detachable cylinder head and cylinder of the C-400 engine

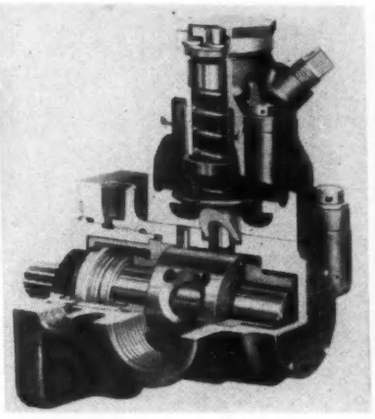
In vehicles for the national defense the radial engine has great possibilities. It is now being used in tanks and planes, but its other possibilities have not yet been explored. Its use in a rear-engine scout car would permit the present hood or motor bonnet to house several machine guns and a light automatic cannon. Thus men could be transported to the front in the scout car and dropped to take up battle positions, then screens of bullet-resistant steel could be raised about the driver and gunner, much as the windows and top of a modern convertible are put up, and the machine could continue as a light tank with the fixed guns in front of the driver by a toe lever and the swiveled guns and cannon in front of the gunner fired by the latter, lying prone.

Such a vehicle would be very light, and would be driven through all four wheels, use being made of the Latil scheme of leaving the front wheels free when running on the road and locking them into the drive when pulling out of mud or crossing bad country.

Color Tolerances

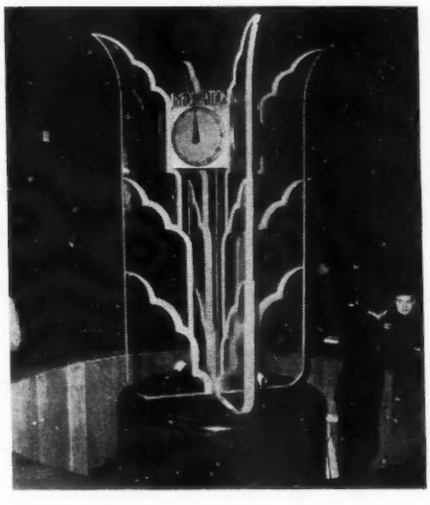
COLOR Research and its Relation to One Phase of the Automotive Industry was the title of a paper by W. H. Beck of Sherwood Brothers, Inc. This paper was a contribution of the passenger-car activity at the SAE and was intended to furnish the basis for a possible future standard for color tolerances. There appears to be a need for specifications of color tolerances in automobile upholstery materials. A group of samples were submitted by the Hudson Motor Car Co. They included both the standard sample and approximately 100 samples taken from the various bolts of cloth delivered to the company. The author said that in viewing these various pieces of material it became very evident that what was lacking was a suitable specification setting the tolerances allowed the dyer from the given standard. In the research work undertaken use was made of a spectrophotometer developed by the General Electric Company from the design of Prof. A. C. Hardy of Massachusetts Institute of Technology.

Fuel Pumps for High-Altitude Aircraft



Pressure on Fuel Line Prevents Vapor Lock.

AIRPLANES flying at high altitudes are apt to suffer from vapor lock, because of the low pressure on the fuel in the suction line of the pump. A fuel feed system designed to eliminate such troubles has been developed by Thompson Products Co. and was described in an SAE paper by W. H. Curtis. A rotary pump equipped with relief valve is mounted directly on, and gear-driven from, the engine. This pump is supplied with fuel from the tank by means of a booster pump—a centrifugal pump direct-connected to an electric motor—the whole unit being bolted to the bottom of the tank, with the motor below the booster pump. Thus the fuel line is at all times under pressure, due to the centrifugal force on the fuel in the pump. This pressure, moreover, is said to have the effect of causing air and gas dissolved in the fuel to separate out and escape upward into the tank. Owing to the presence of the relief valve, the discharge pressure of the pump is independent of the inlet pressure, within normal operating ranges of modern carburetors. It is claimed that with this fuel feed system, using the centrifugal booster pump instead of the conventional hand pump to prime and pressure the system, engines equipped with modern high-pressure carburetors start much easier. It is intended, moreover, to increase the operating speed of the booster to such an extent that its discharge pressure will be sufficient to operate the engine in the event of failure of the feed pump, so that the emergency hand fuel pump now carried can be eliminated.

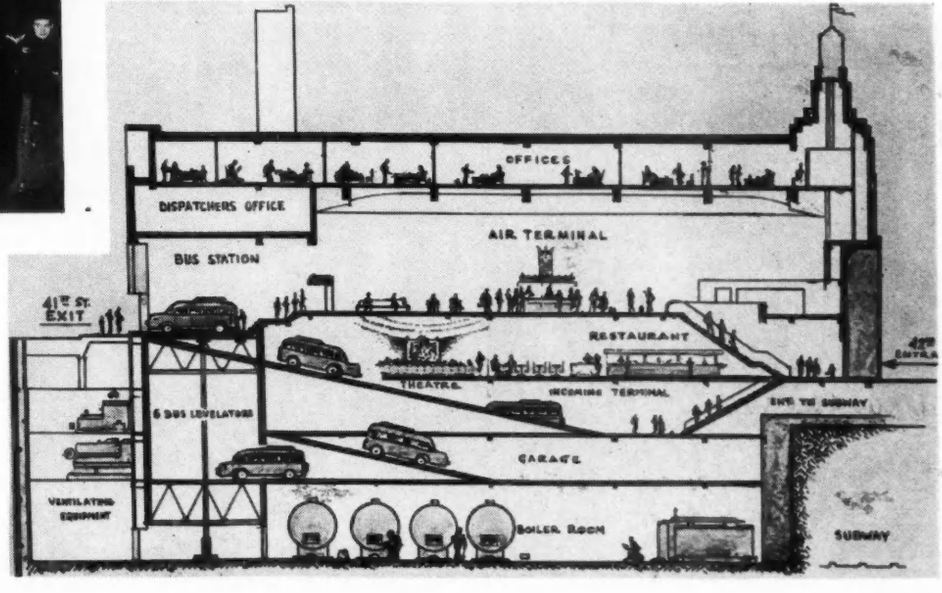


A sculpture, said to be the largest yet made in a plastic material, dominates the information desk. Four large wings of Plexiglas support a clock. Hidden lamps emit light only through the edges of the four wings.

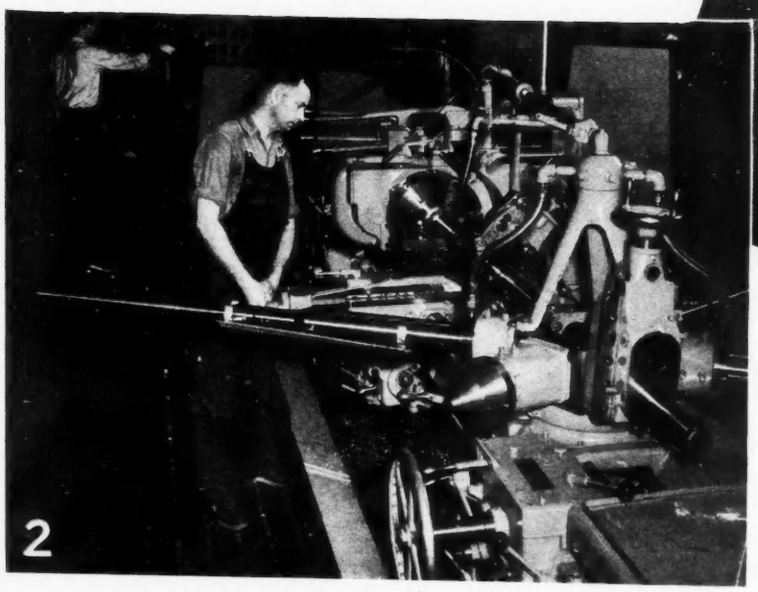
Airlines Terminal in New York

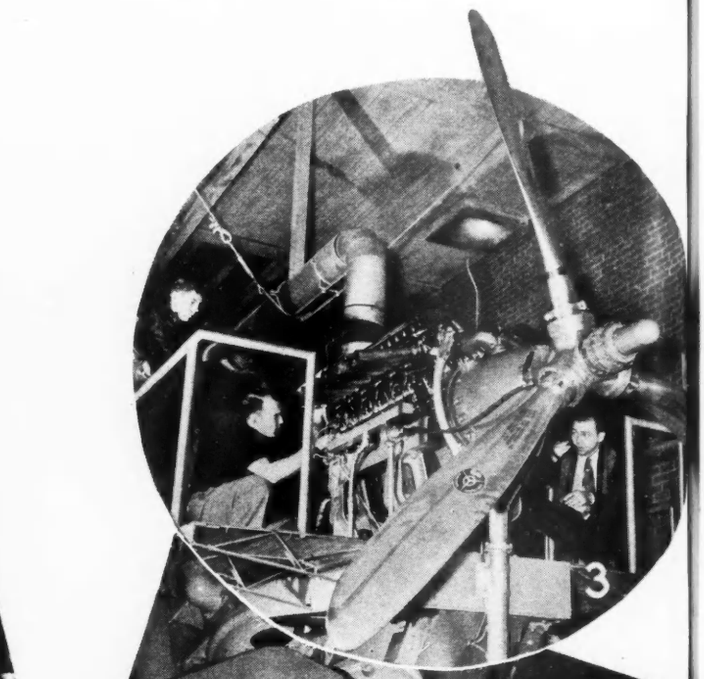
Schematic drawing of the new airlines terminal just opened to the public in New York City. Buses with inbound passengers descend on the ram, discharge their passengers, proceed to the lower level to "levelators" which carry them to the surface where they pick up passengers for the airport. The terminal serves five airlines.

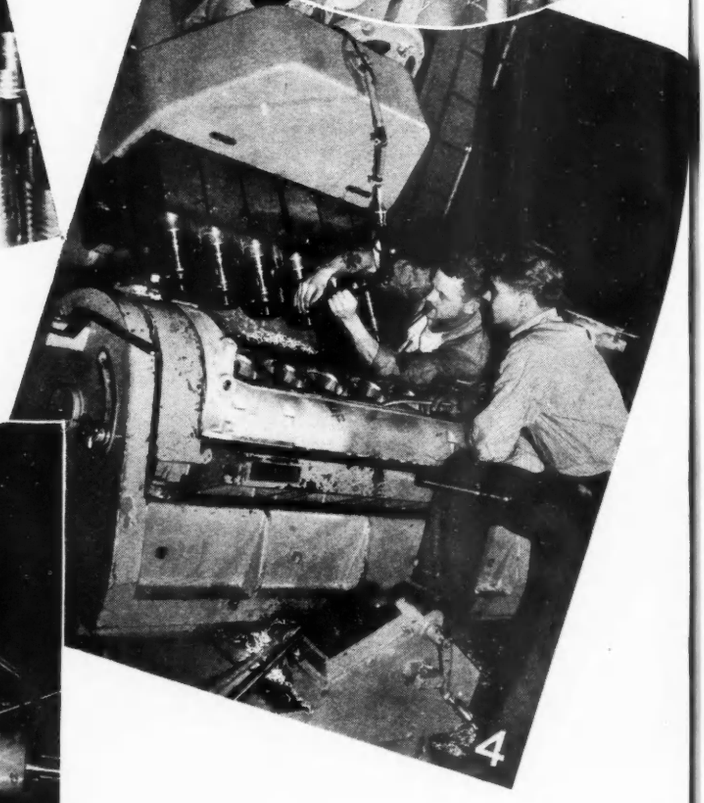
Acme



GM Allison Division Z







Zooms to Action

The Allison Division of General Motors is currently turning out liquid-cooled engines under Army Air Corps and British Government contracts at the rate of 350 a month. Workers total 7,200. By late 1941, when additions to plant now under construction are completed, 10,000 men are expected to be turning out 1,000 engines a month.

1. *The operator is testing the inside of airplane engine cylinder barrels for case hardness. A diamond indents the steel and records the precise hardness on a dial indicator.*

2. *Accuracy is required in turning and boring the outer propeller shaft of an Allison airplane engine. The heat-treated steel shaft is reduced to exact size for assembly in one operation.*

3. *An Allison V-1710 airplane engine passes its final acceptance test. Each engine is operated on a test stand until it develops full power. Then it is torn down, inspected, re-assembled and given its final acceptance test.*

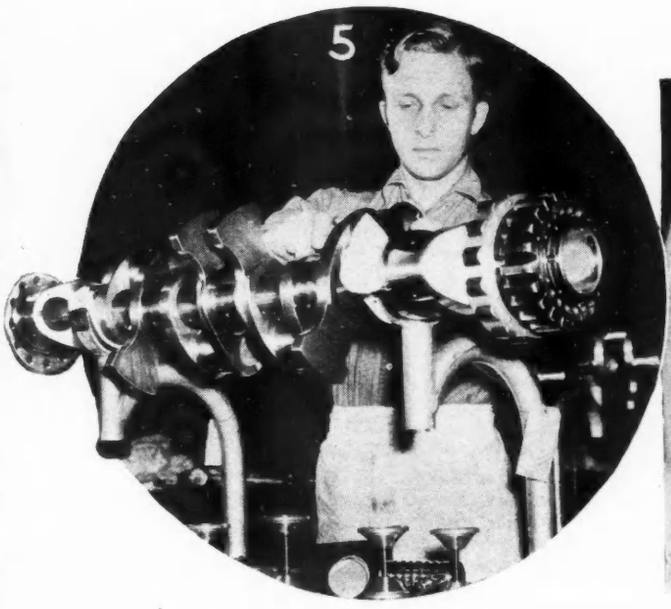
4. *One of the 2,000 "trainees" at the General Motors Allison airplane engine plant in Indianapolis watches a skilled worker set his machine tool for a boring operation. This particular machine bores simultaneously six holes for a cylinder bank in the crankcase of an engine.*

5. *This is the delicately balanced crankshaft of the Allison airplane engine. A workman is shown placing a crank-oil-plug in the shaft. Function of the plug is to allow the entire crankshaft to be filled with oil under pressure.*

6. *View shows inspector looking over a reduction gear which has just been checked on gear recorder for concentricity and spacing of teeth.*

7. *A streamlined Allison airplane engine passes through the "tear down" department. The engine has just come from a test run and is being taken apart so that each unit can be inspected.*

8. *Testing is fully as important as the actual process of manufacture in the production of airplane engines. Here an inspector in the plant uses a height gauge to determine the height and parallelism for the cooling jacket of a cylinder head. Careful checking insures against coolant and oil leaks.*



Design Problems in Aircraft Electrical Equipment

THE ADVENT of modern high-powered airplanes has confronted manufacturers of electrical equipment with a number of difficult problems. Electric power is being used more and more on airplanes for the operation of accessories, and on some of the large four-engined bombers a generating capacity of 36 kw. in several units is now provided. When the development of electrical equipment for aircraft began, manufacturers had automobile experience to guide them, but today requirements in the automobile and aircraft fields are so divergent that experience with automobile electrical units is of little help to the designer of electrical equipment for modern aircraft.

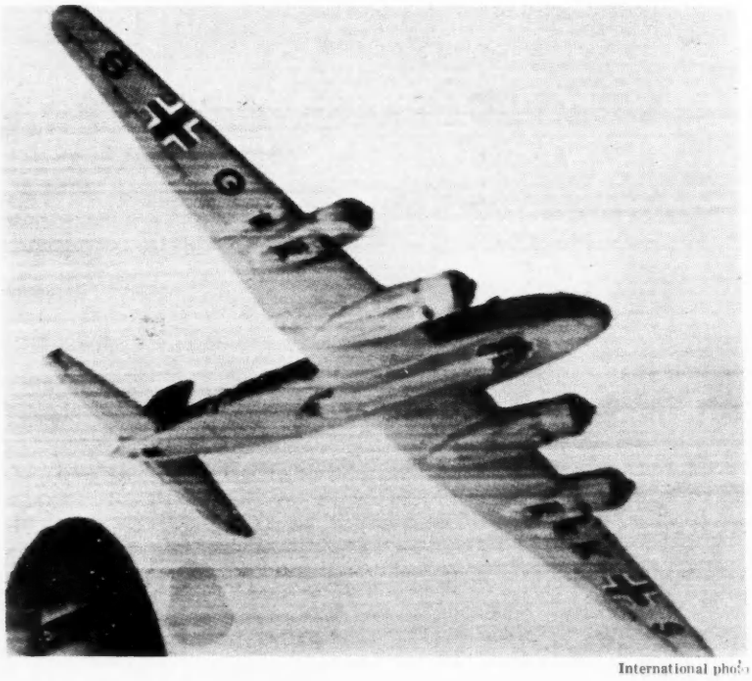
The subject of electrical systems for aircraft came up for discussion at one session of the Winter Convention of the American Institute of Electrical Engineers in Philadelphia, when T. B. Holliday of the U. S. Army Air Corps, presented a paper on Applications of Electric Power in Aircraft. He gave an outline of the development work done by the Air Corps on aircraft electrical installations. One of the problems that arise is whether the generator or generators shall be driven from the main engines of the plane or by auxiliary engines. If they are driven by the main engines, no power is available when the plane is grounded. For the sake of safety it is desirable to have duplicate equipment, so that if one generator became disabled the plane would not be entirely without electric power. One generating plant designed for use on large bombers comprised two 30-hp. auxiliary engines driving two alternators through a gearbox. This equipment did not prove quite as dependable as it was expected to be, for while both the engines and the generators were duplicated, the gearbox was not, and one of the first parts to fail was a gear, which apparently rendered the entire equipment inoperative.

Electric generators and motors for use on aircraft differ from corresponding machinery for stationary work chiefly with respect to specific weight. For aircraft service the units must be exceedingly light. In the discussion of Mr. Holliday's paper, an engineer connected with a large manufacturer of motors for industrial use mentioned that some years ago a customer approached his firm with a request for a motor to weigh around 20 lb. and which would have an output equal to that of stock motors weighing about 300 lb. The proposition seemed so preposterous that it was turned down. However, in recent years the demand for electric generators and motors of such high specific output has become so insistent that the large electrical manufacturers have turned their attention to it.

At the present time the use of auxiliary engines for driving generators seems to be in disfavor, for one reason because the power output of such engines would drop to a small fraction of their rated output at the maximum altitudes now reached by aircraft, unless these auxiliary engines were equipped with superchargers, which latter would add materially to their weights.

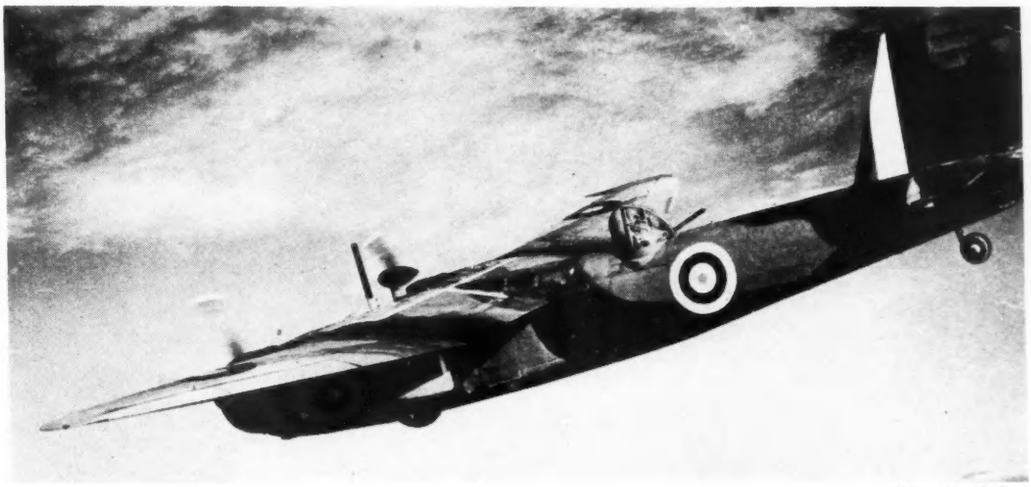
Another question that has arisen is whether direct-current or alternating-current equipment is preferable. In order to obtain large outputs from generators of given weight, they must be driven at very high speeds, and speeds of 24,000 r.p.m. were repeatedly mentioned at the session. At such high speeds, difficulties in commutation arise in the case of direct-current machines, because the friction losses at the commutator increase with the speed and the commutator will

(*Turn to page* 188, *please*)



International photo

This Radiophoto has just been released by the German censor. It is described as a Focke-Wulff "Kurier" and as a four-motored bomber. It corresponds to the U. S. B-17 or 19. Note should be taken of the gunners under the fuselage both fore and aft.



International photo

Doing service over the sea for the Royal Air Force is this Blackburn "Botha" plane. It is powered by two 890 hp. Perseus engines and is used for general reconnaissance and torpedo carrying.

Can Airplane Speed Reach the Velocity of Sound?

TWO SESSIONS on rotating wing aircraft marked the high point of the 1941 Annual Meeting of the Institute of Aeronautical Sciences which was held over a three-day period in the Pupin Physics Laboratory at Columbia University, New York City. Leading aircraft authorities agreed that more advance has been accomplished during the past 12 months in this field than during any similar period of aircraft history. Following his paper describing the V-S 300 helicopter, a moving picture of Igor Alexis Sikorsky, Vought-Sikorsky Aircraft division of United Aircraft Corp., showed him taking off, flying backwards and sideways at will, and landing.

Dr. Theodore von Karman, director of the Guggenheim School of Aeronautics, California Institute of Technology, explained the work he has been doing on study of the compressibility effects in aerodynamics. This work, he told AUTOMOTIVE INDUSTRIES, has an important bearing on the problem of maximum speeds obtainable by the present type of airplane. He told his audience that "The aeronautical engineer is pounding hard on the closed door leading into the field of supersonic motion. I realize the price to be paid for any further increase of speed becomes higher and higher, but it is apparent that some mathematical theory could be used as a guide in order to avoid premature drop in aerodynamic efficiency."

Following a discussion of the present theory of compressible fluids from a mathematical standpoint, Professor Karman announced a new method for the computation of the effect of compressibility on lift and drag of airfoils at high speed. "It has been found," he said, "that flight with a higher velocity than the speed of sound unavoidably involves excessive drag and poor carrying capacity of the airplane. In my opinion," he said, "the gap between the present aircraft speeds and the velocity of sound (about 741 m.p.h. in dry air at 32 deg. Fahr.) might be narrowed substantially by careful theoretical research."

Radio and instruments were the subjects of five important papers at one session, and two sessions were devoted to meteorology. One session was devoted to physiological problems encountered in flying, including the use of oxygen, and studies of high-altitude flying.

FIVE papers were presented on aircraft structures; three on organic and synthetic materials; five on airplane design; five on aerodynamics; and three on powerplants completed the meeting.

The 1940 Daniel Guggenheim Medal was presented to Glenn L. Martin, president of the Glenn L. Martin Co. of Baltimore. Dr. Jerome C. Hunsaker, head of the mechanical engineering department of Massachusetts Institute of Technology, made the presentation. Frank W. Caldwell, director of research, United Aircraft Corp., is the new president of the Institute.

This P-40 pursuit plane of the 79th Fighter Squadron is being refueled from a truck and trailer combination which carries a load of 8,000 gallons. Dual wheels and tractor treaded tires keep it on the job of servicing the planes in mud and high water

A show of progress is seen in the yard of the Consolidated Aircraft Corp. This view shows bombers being assembled

Aircraft Engine Testing Equipment

A LABORATORY for the development of modern aircraft engines must provide not only dynamometer equipment for complete engines, but also facilities for the study and development of a wide range of component parts, such as cylinder-and-piston combinations, engine fuel systems, induction systems, ignition systems, reduction gears, superchargers, etc. The laboratory must be equipped for carrying out torsional and linear vibration studies on component parts and on complete multi-cylinder engines. In a paper on "Modern Aircraft-Engine Testing," presented at the S.A.E. Annual Meeting, W. D. Gove of the Pratt & Whitney Aircraft Division of United Aircraft Corporation dealt only with some of the major items of test-house equipment.

The multi-cylinder dynamometer should be of the cradled type, in which engine output is determined by measurement of the shaft speed and the torque reaction. Experience has indicated that it is impractical to test an engine on a dynamometer with a maximum capacity of more than three times the engine rating, on account of the low sensitivity of the apparatus near the lower end of its range. The dynamometer "motoring" capacity, made use of in friction horse power tests, should be at least sufficient for full-speed friction runs.

A large-capacity dynamometer generally comprises a motor of sufficient capacity to meet the motoring rating, and in addition a supplementary unit capable of absorbing power only. The two machines are cradled, and their combined torque reaction is weighed on a single scale.

Reduction gears can be set up for durability tests in pairs, in such a manner that the two input members are connected together and also the two output members. The gears are then loaded with a windup mechanism, and an external motor rotates the two units, supplying friction power only.

Complete accessory sections of engines can be checked for lubrication and durability on stands supplying power for driving the unit. A test stand for this purpose need not necessarily be capable of measuring the power supplied, although the scope of its usefulness is greatly increased if a complete cradled dynamometer is used.

Equipment for carburetor flow tests must be carefully designed to minimize fire and explosion hazards. The discharge of combustible mixture from the vacuum pump is the major problem. One solution is to arrange a fan system in the vacuum pump discharge stack which dilutes the mixture with about ten times its volume of fresh air, thus leaning out the mixture beyond the combustible range.

Testing hazards must be guarded against, especially when new men are being trained. Undoubtedly the gasoline supply system used in testing should receive first attention. The use of pipe trenches or pits under test cells should be avoided wherever possible. Gasoline lines should be run exposed and kept away from other pipe lines carrying hot substances. Needless to say, electrical equipment operating near gasoline systems should be explosion proof. If the gasoline is kept in a closed system and carburetors are run dry when engines are stopped, the observance of a few common-sense rules should prevent any troubles from gasoline.

Inasmuch as test operators are separated from the engine by heavy masonry walls, little hazard exists from engine or propeller failure. In cases where it is absolutely necessary for an operator to approach an engine while running, it is highly desirable to provide a safety-tread platform and an approach from behind.

It is believed that if control-room noise levels are kept below 100 decibels, permanent deafness from engine noise can be avoided. A level of 80 decibels has been obtained in recently-constructed test-stand control rooms, and there conditions are quite comfortable. Control rooms should be checked periodically for excess carbon monoxide.

PRODUCTION LINES . . .

A Vital Point In Small Shop Sub-Contracting

SIGNIFICANT feature of the state of national defense at the present moment is the urgent need for enlisting the active cooperation of the thousands of small manufacturing plants of the automotive industry to serve as sub-contractors on ordnance products. How to effect this cooperation most effectively is a problem engaging the thinking of the officers and civilian personnel of the ordnance department of the U. S. A. and many others.

Faced with the grim realities of the situation, the people concerned with ordnance procurement realize that the standardization of methods of manufacture is out of the question. Indeed the pressing problem is that of skillfully adapting processes specifically to the manufacturing equipment at hand.

In this emergency the best job and the most economical job is one than can be facilitated by improvising fixtures and tooling on general purpose machines, to achieve the results of advanced techniques with specialized equipment.

It is realized by the practical men in various ordnance areas that the skill of production men in the parts plants of the industry can find a way to do the job in a hurry. Certainly it is plain to see that the machine tool manufacturers must be relieved of as much of the burden as possible so that they may concentrate their efforts on equipment required for outfitting the new aircraft engine plants, new tank arsenals, and the like.

Stepped Up

It's not often that we get an opportunity to toot our own horn—but here is a good one. The Cincinnati Milling Machine has just issued a spiral-bound book containing a series of page advertisements which appeared in AUTOMOTIVE INDUSTRIES in recent issues. The book is appropriately titled—"How to Step Up Production with Cincinnati Hydro-Broach Machines." We say "appropriately" because each of these advertisements was designed as a specific case study of a surface broaching application in an automotive plant. Consequently, this book represents a handbook of practice and as such should fill a place on your book shelf. Ask us for a copy of this instructive manual.

Molding Plastics

During the SAE Annual meeting, Bakelite distributed a handsomely illustrated book on the subject of "Bakelite Molding Plastics." It's a good engineering handbook, giving not only many of the current applications but outlining the properties of various materials in tabular form. In addition, there is a plastics comparator chart which enables the engineer to compare the significant characteristics of different materials. We shall be glad to get you a copy.

Flexible Bearings

Some months ago we described a new type of bearing consisting essentially of a seamless tube of rubber stretched between two metal tubes of different diameters. The constant tendency of the rubber to return to its original form insures a high capacity bond, permits of varying degrees of flexibility in the member. What started as a simple bushing design has been expanded into shock absorbing members for a wide variety of mechanisms—in bushings for heavy-duty presses, in a bushing for an electric motor providing electric insulation as well as a reduction in starting torque, in a bearing for tractor track rollers where it eliminates lubrication and takes shock loading. We could go on indefinitely, but it is far simpler to refer you to the makers of Harris Torflex bearings for the complete story.

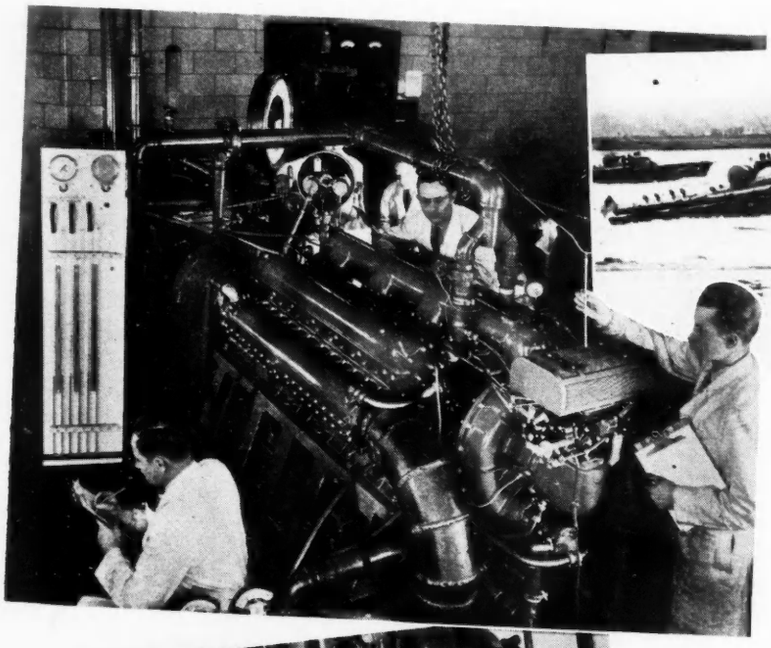
Grease Tests

Continuing its timely bulletins on matters of interest to automotive engineers, *Lubrication* for December, 1940, devotes its entire contents to the evaluation of the ball and roller bearing greases. After describing the significant characteristics of acceptable greases, this bulletin illustrates and describes the various testing machines now employed in the study of such materials. This summary of standard test equipment should be of interest to engineers and research laboratory workers.

Year Book

Friends of Pratt & Whitney will find much of interest in the P & W 1940 Year Book, marking not only the 80th anniversary of this fine organization but signalizing its first full year in the magnificent new Hartford plant. Apart from the sentimental associations, you will enjoy the intimate scenes in the plant, the close-ups of many precision operations.—J. G.

Packard Powers

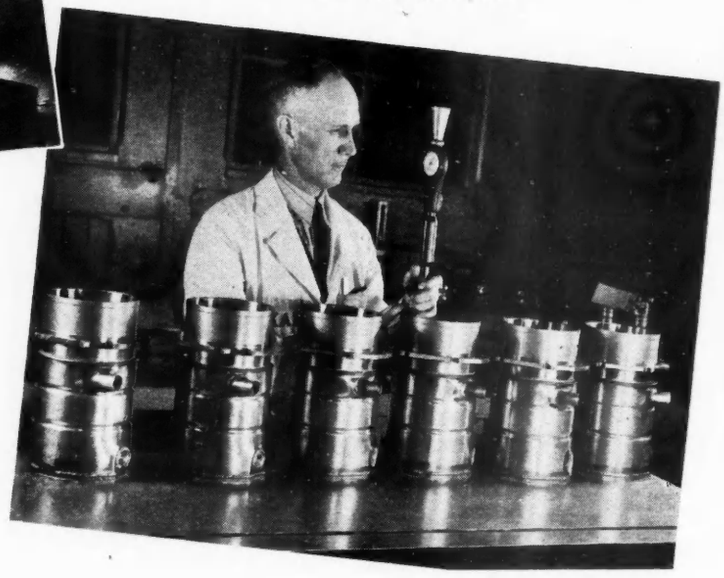


HISTORY repeats as Packard Motor Car Company, builder of Liberty engines in World War I, becomes the source of supply of power for the Navy mosquito fleet in the current National Defense Program. Most sensational of the "water wasps" of the Navy is the PT-10 built by Elco Division, Electric Boat Corp., each one powered with three of the Packard 1350 hp., aviation type, marine engines. Speeds far exceeding 50 mph. have been recorded in early trials.

Through the courtesy of the Packard

(Top right) The U. S. Navy's Mosquito Boats are claimed to be the fastest craft afloat

(Top left) Final acceptance test-dynamometer schedule on the 1350 hp. Packard engine in the dynamometer test room on the first floor of the marine engine plant



(Above) The cylinder barrel bore, of nominal 6.375 in. diameter, is finished-honed on this Barnes Drill Co., honing machine which is fitted with Micromatic semi-automatic tools; and a Micromatic fixture designed to tilt for inspection and gaging as shown. Approximately 0.002 to 0.003 in. of stock is removed in one operation from a ground finish, producing accuracy for roundness and straightness within 0.0005 in., and a final surface quality within 4 to 7 microinches (rms).

(Right) Example of the painstaking care with which marine engine parts are handled is this inspection operation on the cylinder bore. Each bore is checked with an internal gage to 6.375 plus or minus 0.001 in.

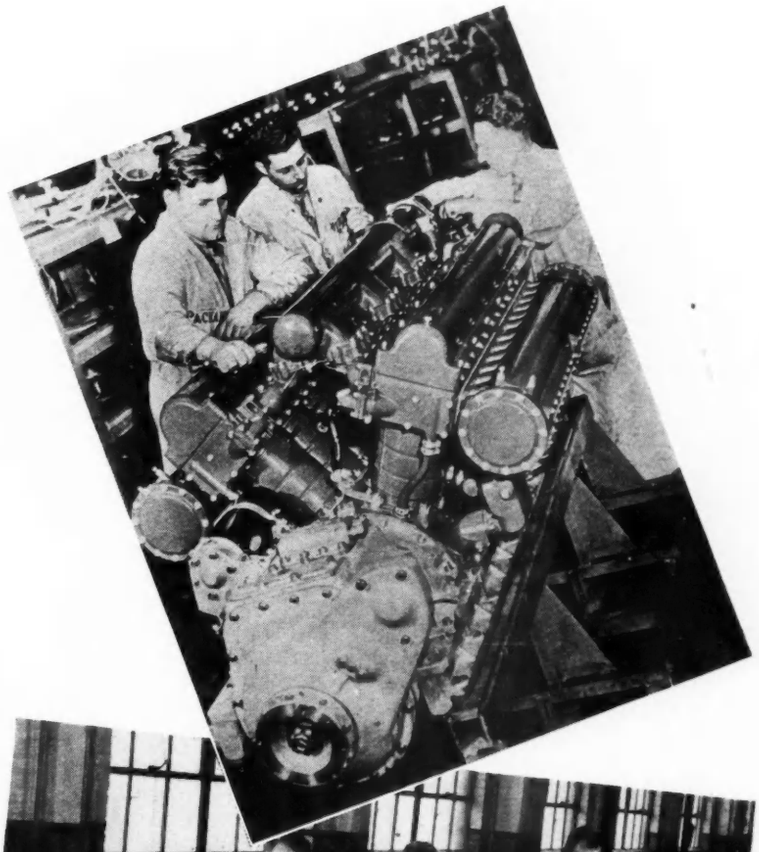
the Mosquito Fleet

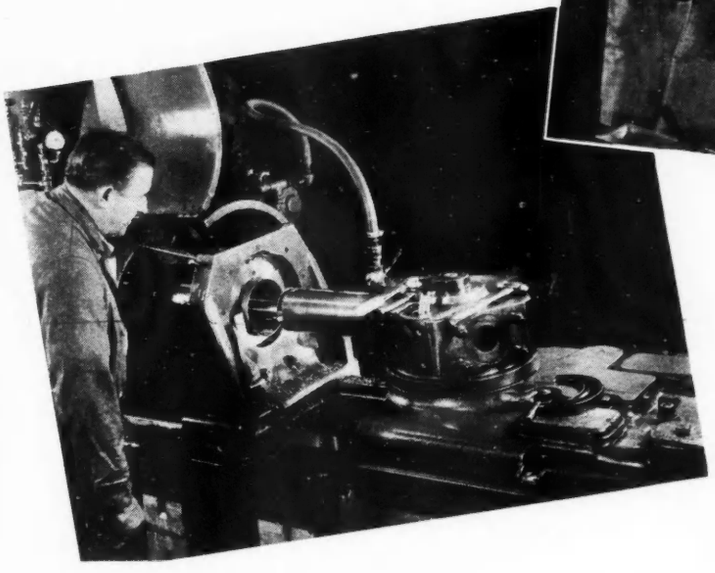
management, and with the approval of the Government agencies, we present here a pictorial high-spotting of machining and assembly operations on major parts of the engine, emphasizing the exceptional refinements in manufacturing methods demanded of a powerplant of this character.

In every detail, the quality of precision workmanship is representative of the best aircraft practice, extending to the final test schedule where the engine is torn down for inspection after the initial testing, then re-assembled and run for acceptance.

At the present writing, the marine engine plant employs 500 hourly workers, includes also a group of some 50 Packard trainees who will acquire a working knowledge of precision manufacture, preparatory to service in the Rolls-Royce manufacturing program which will be underway early this year.

The marine engine plant occupies three floors of one of the buildings in the Packard plant, accounts for 87,116 sq. ft. of productive floor space. The first floor houses the machining facilities for the major parts such as the cylinder barrels, connecting rods, crankcases; also contains the dynamometer test room. The second floor boasts a large air-conditioned department for engine assembly





(Top) Packard is using the Rolls-Royce engine plant. Nine thousand engines are on order. Workmen are shown putting the finishing touches on a 1350 hp. V-12 powerplant for the U. S. Navy

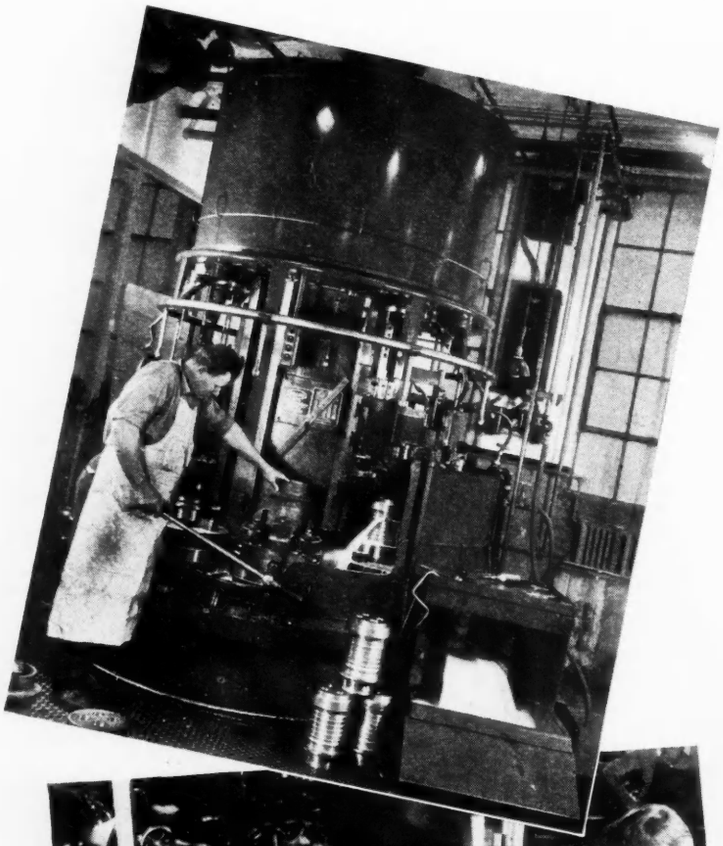
(Above) Here is a corner of the air-conditioned assembly department, showing the crankshaft subassembly operation. This crew of operators is completing the assembly of rods, ready for installation in the crankcase

(Left) Finish-boring of the Packard cylinder barrel on a 5D Potter & Johnston heavy-duty turret lathe. The bore is finished to 6.352 in. plus 0.000, minus 0.002 in.

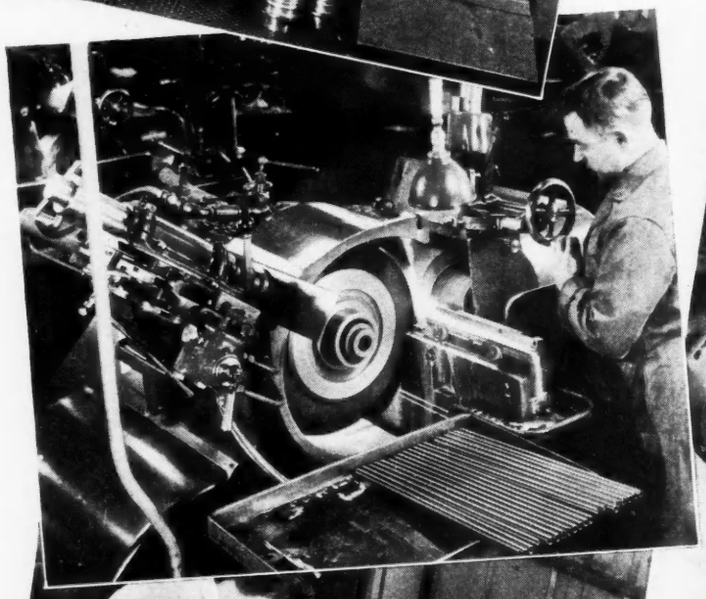
MARINE ENGINES

and tear-down. Among the interesting items of equipment on the third floor is a large battery of the latest editions of the well-known Warner & Swasey turret lathes.

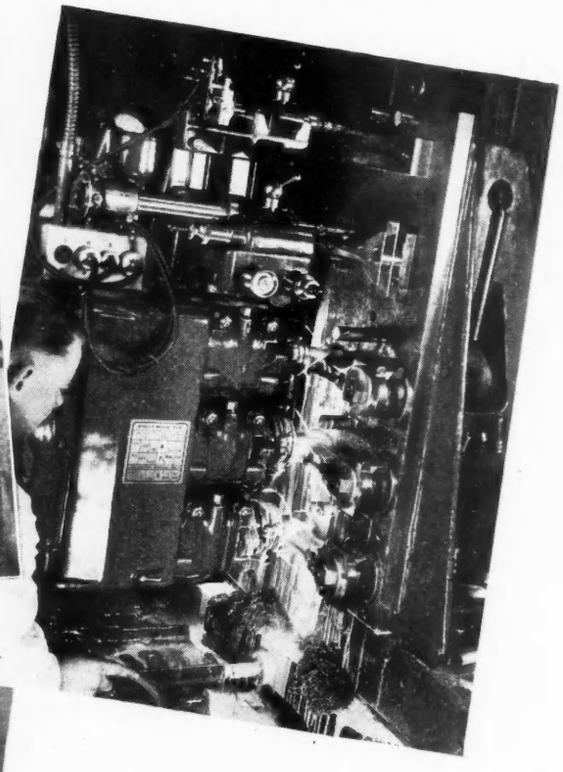
Perhaps the most arresting characteristic of every piece of heavy-duty equipment in this plant is that of massiveness. It is evident that in the selection of machinery there was a deliberate plan to adopt sizes which far exceed the normal demands of a given operation. This over-sizing has provided the rigidity and freedom from vibration or chattering so essential



(Left) Cylinder barrel forgings are rough-machined, completely, on this eight-spindle, Type D Bullard Mult-Au-Matic. The bore, outside diameter, and the turning of both ends is done in two chuckings in this huge machine. Incidentally, the bore is both rough- and semi-finish bored in this operation



(Center left) One of a battery of new Cincinnati Centerless Grinders in the marine engine department. Operation shown here is that of finish-grinding the O.D. of the camshaft rocker lever shaft—0.6346 in. plus 0.000, minus 0.0005



(Above) This view shows the familiar Keller die-making machine used for finish-machining the connecting rod forgings. The operation is controlled by the tracer arm which "feels" the countours of a master rod, assuring uniformity of weight and all over finish

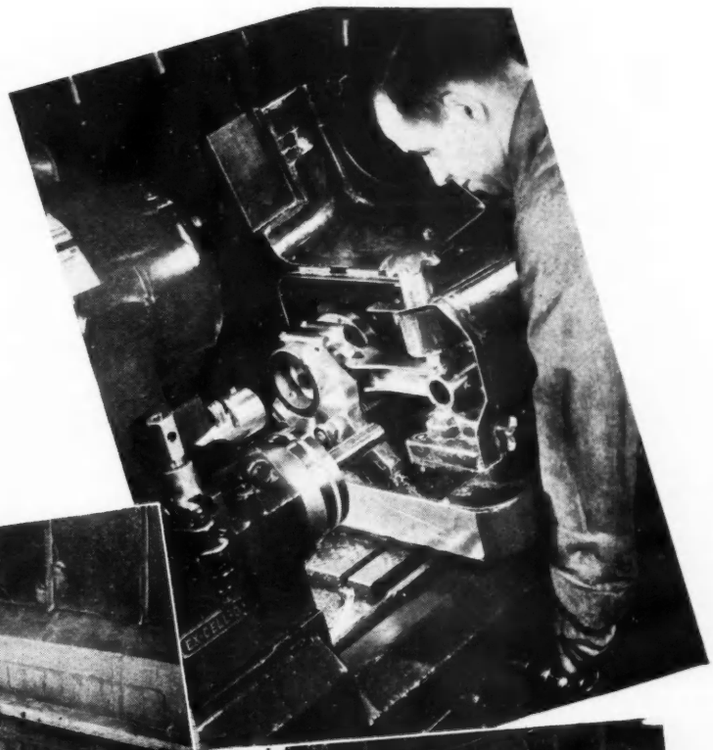
(Bottom) A magnaflux machine is used for checking the major parts of the engine to assure freedom from minute cracks or imperfections. This view shows the examination of a finished crankshaft

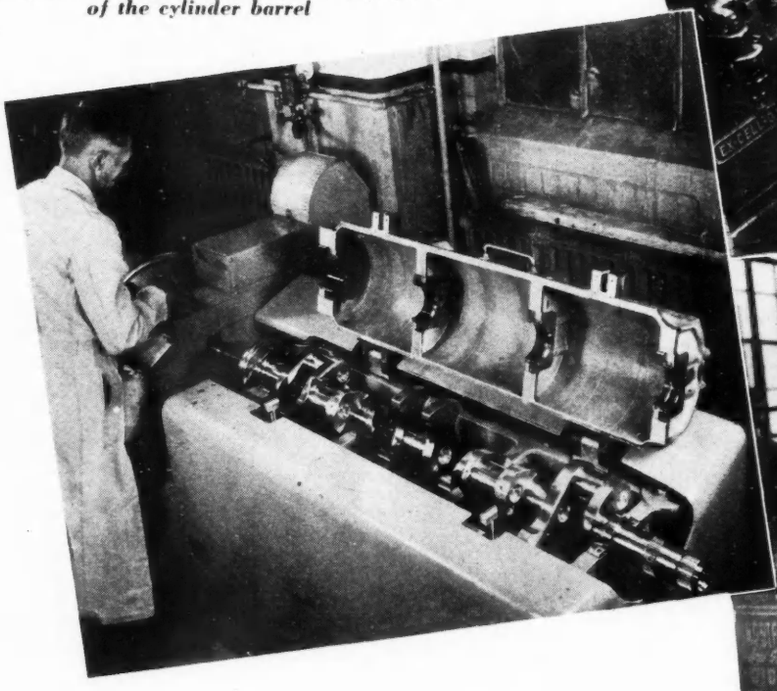
(Right) Precision boring of both ends of the connecting rod and cap assembly (fork) is done in one setting in this Ex-Cell-O, two-spindle precision boring machine. The piston pin hole is held to 1.502 in. plus or minus 0.00025, while the crankpin bore is held to 3.2540 in. plus 0.0005, minus 0.0000

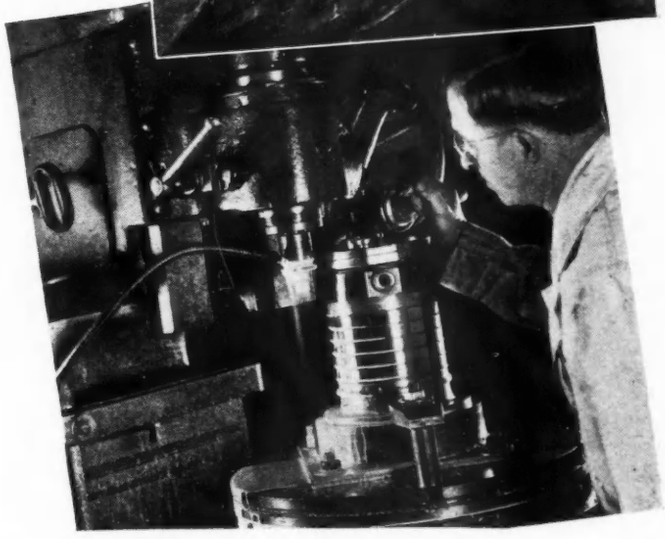
(Center right) No. 33 Sundstrand Hydro-Screw Rigidmill, a new heavy-duty model, is employed for the milling of both seats on the rod, nut seats on the cap, and sawing apart of the cap end.

(Below) Crankshafts are balanced both statically and dynamically, static balance being held within 0.75 ounce inch. They are balanced dynamically in this GMR balancing machine, being held to 0.75 ounce inch at the centers of the end crankpins.

(Bottom) A Brown & Sharpe vertical milling machine with an indexing table is used for forming the outside contour of the top plate of the cylinder barrel







to the maintenance of high standards of quality, both in the character of surface finish and in fineness of dimensional accuracy.

Before proceeding with the pictorial section, it may be of interest to note some of the significant specification details of this engine—

Model: 4M-2500
Type: 4 cycle gasoline
Number of cylinders: 12
Cylinder arrangements: Vee 60 degrees included angle
Induction system: Suction, supercharger and carbureter
Ignition: Spark, supplied by magneto
Total piston displacement: 2490 cubic inches
Bore: 6⅜ inches
Stroke: 6½ inches
Compression ratio: 6.5
Cooling: Pump circulated distilled water
Weight stripped engine: 1,950 pounds

RATING AND PERFORMANCE

Emergency: 1350 hp. at 2500 rpm. 15 min. in one 10-hour period
Maximum: 1200 hp. at 2400 rpm. 1 hour in one 25-hour period
Maximum Cruising: 900 hp. at 2100 rpm. Normal operation

OILING SYSTEM

Pressure feed dry sump type utilizing positive displacement pressure and scavenging pumps mounted as an assembly with pressure control valve on lower crankcase at supercharger end of engine.

THE CONSOLIDATED PRESS DIVISION of E. W. Bliss Company, Brooklyn, introduces a new machine of greater size and capacity for its inclinable press line. This Bliss No. 10 Inclinable Press is a general purpose machine with strokes ranging from 8 to 12 in., and a bed size of 35 in. by 53 in. A hammer forged crankshaft made of a special grade of steel coupled with a flanged slide of large area are featured on this machine.

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., has added to its products a smaller milling machine called the No. 00 Rigidmil, which is available in two models—one with power feed and the other with hand feed.

The power feed machine has a hydraulically actuated table with a maximum stroke of 8 in. and traverse rate of 400 in. per min. Feed and traverse strokes can be regulated to suit requirements of the job. In addition, the machine has a wide range of spindle speeds, which permit the machining of all types of materials without sacrifice in production or finish. Separate motors drive the head and hydraulic unit. Automatic lubrication is provided to all moving parts.

The hand feed model, which has the same basic units as the hydraulic feed machine, is designed so that it can be converted to a power feed machine if necessary. Either a hand lever or a hand wheel is furnished, the former for short table movement and the latter for long table movement.

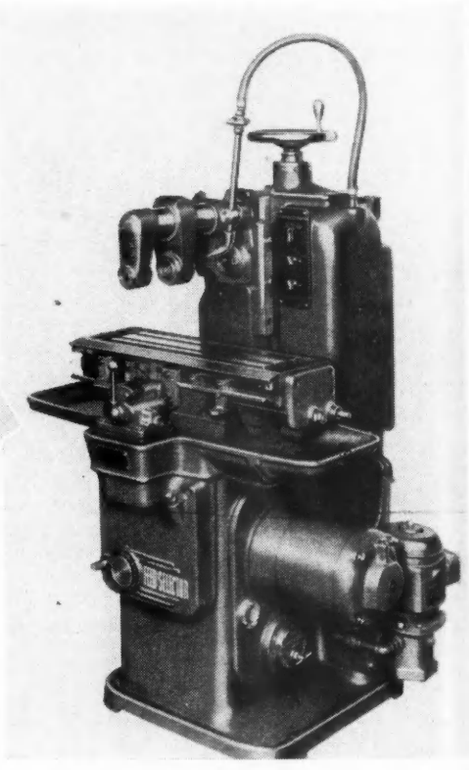
CONTINENTAL MACHINES, INC., Minneapolis, Minn., manufacturers of Doall Contour machines for continuous sawing, filing and polishing, announces a new model V-60, which is designed expressly to meet the demands for heavy machine tools in the defense industries. Featuring a 5-ft. throat depth, large machining jobs can be handled in this model.

Work up to 12 in. in thickness can be cut with considerable speed and precision since the machine uses narrow band Doall precision saw blades varying from 1/16 in. to 1 in. in width. Standard equipment includes a butt welder that joins the 1-in. saw blades as readily as it does the extremely narrow blades. This welding is instantaneous and automatic in operation. It is equipped with two 30-in. square work tables.

Although massive in size to handle large jobs, it is designed to provide flexibility and accuracy needed for the sawing or filing of parts to close tolerances. The hydraulic contour feed control in connection with the power feed reduces the operator's attention and a speedmaster variable drive provides every speed from 50 to 1500 ft. per min.

MEN and

Bliss No. 10 inclinable press



Sundstrand No. 00 hydraulic Rigidmil

MACHINES

MAJOR characteristics of rubber products made by the Harris Products Co., Detroit, are checked with the Gogan production and research instruments. The Gogan machine at the left is a frictionless rubber compression testing machine, an adaptation of the Brinell machine, suitable for obtaining the actual deflection of bushings under given loadings. Unique feature of the machine is the employment of a magnetic circuit for operating the deflection indicator. The machine is arranged to apply a minor load of 10 kilograms, then a major load of 180 kilograms. The smaller instrument at the right is a Gogan Model D-11 frictionless penetrating rubber testing machine, with loading from two to five pounds.

THREE new small paint-circulating systems for finishing-room use have been announced by The DeVilbiss Co., Toledo, Ohio. These systems will supply up to six production-type spray guns in continuous operation, handling such materials as lacquers, synthetic enamels, paints, varnishes, and shellacs.

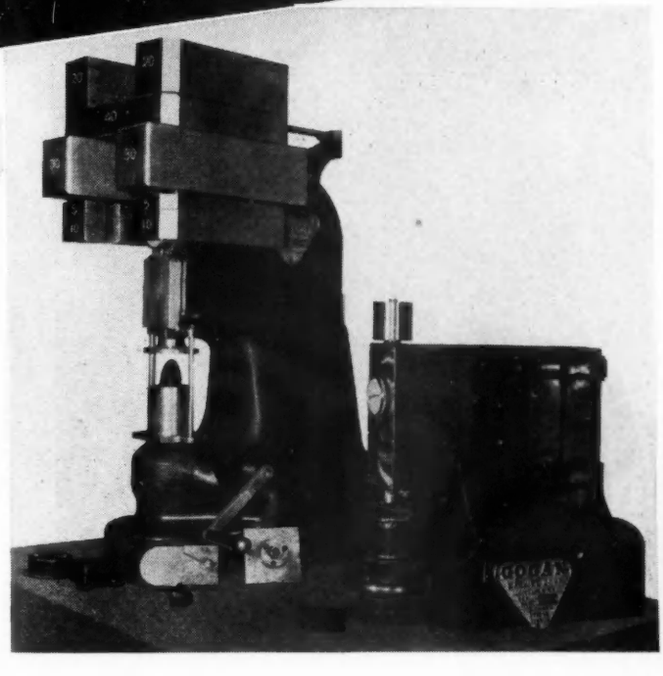
The container is a standard Type QM unit (with agitator), of 30 or 60 gal. capacity. The specially designed motor-speed reducer-pump combination is mounted compactly on a small platform on the lid of the tank, the motor being either of the air or electric type. Motors have sufficient power to circulate fluids with a maximum viscosity of 25 sec. (determined with a No. 4 Ford cup) against an average loop pressure of 50 lb. per sq. in. The pump is the newly improved Type QB, which is provided with a mechanical seal instead of the usual packing gland.

(*Turn to page* 190)

A new machine of special interest to automotive manufacturers who have taken on armament work for defense is the Pratt & Whitney gun barrel rifling machine which incorporates two complete units on a single bed. Each spindle unit is complete for independent operation. Cutting speed is controlled hydraulically

(Lower right) Gogan rubber testing machine

(Below) Doall V-60 continuous cutting machine



MEN AND MACHINES

Automotive MATERIALS 48

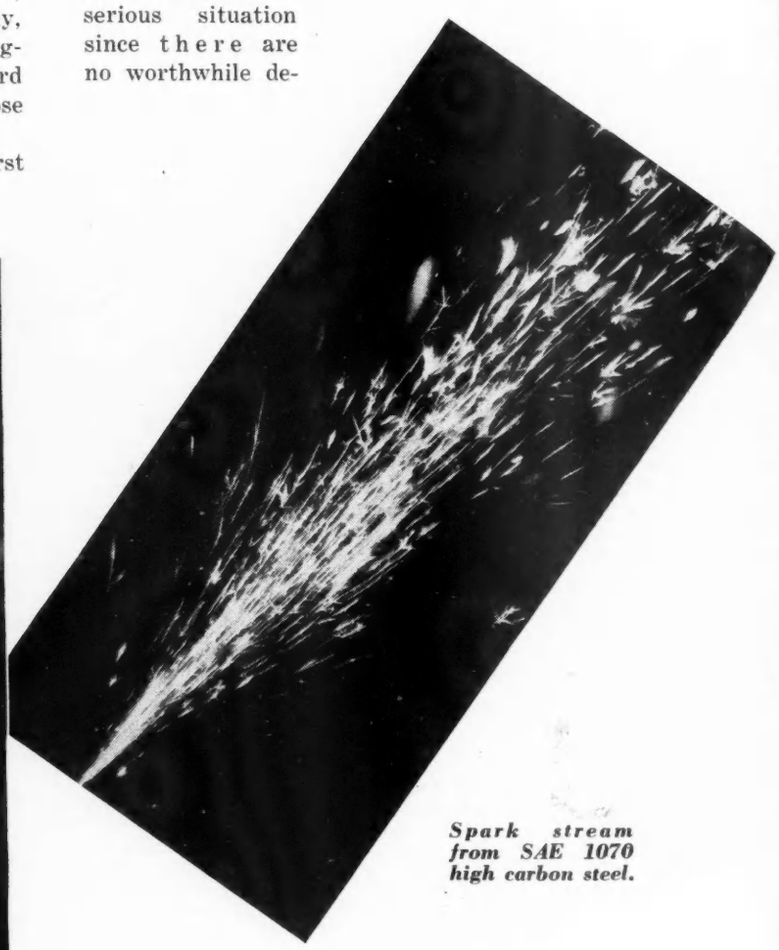
Strategic Metals And Their Future Supply

STRATEGIC metals—those metals needed for war purposes and not available in this country in sufficient quantity—are receiving more and more attention, with consideration being given to means of making them available or providing satisfactory substitutes.

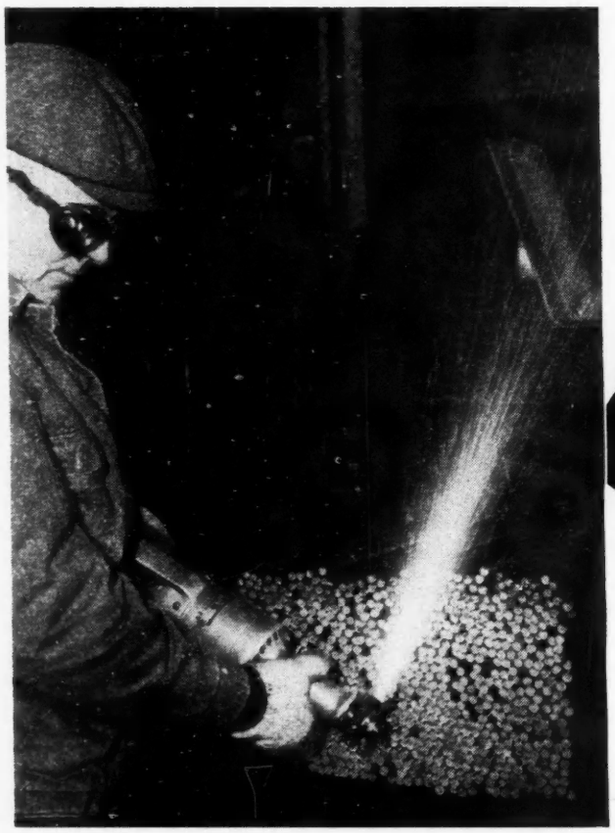
At the annual S.A.E. meeting in Detroit they were discussed thoroughly by two prominent metallurgists, Dr. H. W. Gillette of the Battelle Memorial Institute, and Zay Jeffries of the General Electric Company, who included antimony, manganese, chromium, tungsten, tin, mercury and nickel in this group. Toward the end of the World War, prices of these metals rose to unprecedented heights, due to their scarcity.

It was pointed out that the World War was the first in history in which production behind the lines was the controlling factor, but then the supply of metals was sufficient for both war equipment and home products. The situation is different now, since aircraft is playing a dominant part. Until now only about 5 per cent of the total aluminum production in this country has gone into aircraft, and if aircraft production were suddenly increased 20-fold, then the entire aluminum production of the country would be required for aircraft and there would be nothing left for other purposes.

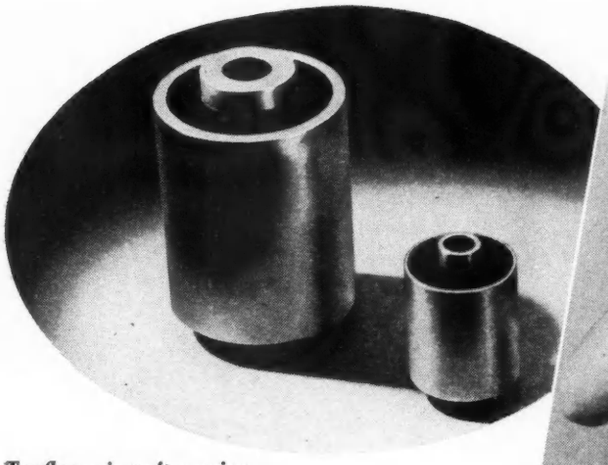
No immediate danger of a shortage in any of the strategic metals is believed to exist here, as stocks of them have been piling up rapidly during the past six months. As to their future supply, tin is said to present the most serious situation since there are no worthwhile de-



Spark stream from SAE 1070 high carbon steel.



(Left) Checking steel in the Buick engine plant by the spark method.



Torflex aircraft engine and cowl mountings.

Flexseal airplane window has flexible plastic frame.

posits in this country. Most of it comes from the Dutch East Indies, but there are large deposits in Bolivia. The total tin consumption was broken down into the amounts used for different purposes, such as tin cans, solder, and bearing alloys, and it was shown how in each field of application tin could be replaced by other materials.

Many engine manufacturers already use bearing alloys other than the standard tin-base babbitt, and, besides, the swing to bearing shells with very thin linings has greatly reduced the amount of time required for this purpose. The possibility of substituting silver for tin-base bearing alloys was discussed, and it was pointed out that silver is already being used successfully for aircraft engine bearings. In an emergency, it was stated, the 100,000 ton stock of silver which the Government has accumulated would last 10 years when used for bearing purposes.

Research was advocated to discover methods of economical utilization of low-grade manganese ores, which are available in this country and Cuba. At the present rate of steel production, nearly 90,000,000 lb. of manganese is required each year, most of it being obtained from foreign sources of high grade ores.

Checking Steel at Buick Plant By Spark Method

SPARK testing is now being used more extensively in automobile plants for checking the grade or character of steel stock. As shown in the accompanying photographs, which were taken at the Buick engine plant, the operator is checking a steel bar. With carbon steel, it is claimed that in the case of those having up to .30 per cent carbon content, an expert operator can estimate the carbon content with an accuracy of plus or minus .02 per cent carbon. At the Buick plant transmission gear stock, valve rocker arm shaft steel, torque tube stock, high speed tool steels, high chrome stock, and others are so checked.

Wool-Like Fibers From Soybean Meal

ALTHOUGH the plastic automobile body is not a reality as yet, having brought it to its present stage of development has won renown for Robert A. Boyer, Ford chemical engineer, who was presented the 1940 distinguished service award by the U. S. Junior Chamber of Commerce in recognition of his far reaching accomplishment in that field.

In accepting the award, Mr. Boyer reviewed the early efforts of his group of young research workers at the Ford laboratories in Dearborn, Mich. How they began with the general theme of developing industrial uses for farm crops and then concentrated on the soybean because of that crop's potentiality as an industrial raw material. To find uses for its two products, the oil and meal, led them into many fields, such as paints, adhesives, plastics, and fibers.

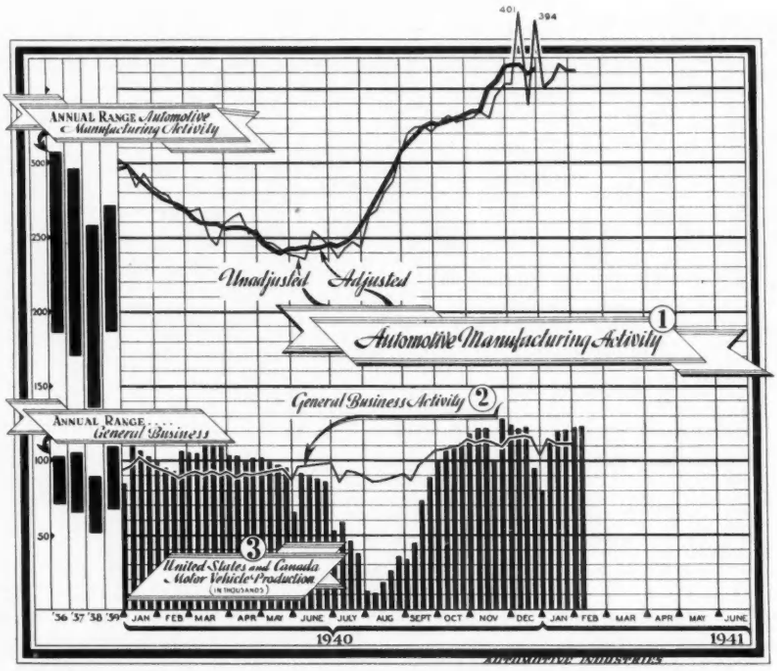
After developing practical uses for the oil, attention was given to the meal. It contains about 50 per cent protein, he said, and one of the novel ways they are using the protein now is in the production of synthetic fiber, which is similar to wool in many of its characteristics and offers interesting possibilities for fabrication into upholstery material.

Building of their first plastic automobile body was announced as nearing completion. The problem is a complex one, Mr. Boyer stated, and the finding of a suitable plastic material after two years of extensive tests was really only a starting point. The actual manufacture of panels by a method suitable to mass produc-

(*Turn to page* 189, *please*)

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive general business charted

February Production Off To Flying Start

PROSPECTS of the biggest February automobile production since 1929 are evidenced by an output of approximately 243,000 motor cars and trucks in the first half of the month. Continuing the same high productive rate that set a new record for January manufacturers operated at near-capacity to supply the big sales demand and also build up field stocks. Dealers as well as manufacturers were increasing their inventories as a hedge against any possible future curtailment of passenger car production. However, likelihood of any curtailment in the near future appears remote.

Record February production was set in 1929 with an output of 497,706 cars and trucks. This month is likely to prove the second highest February on record, exceeding the total of 422,225 established last year. January production of 503,600 vehicles in U. S. plants, according to estimates of the Automobile Manufacturers Association, was 25 per cent ahead of January, 1940, the same rate of gain that domestic production in 1940 enjoyed over the 12 months of 1939. February with 20 working days has two less than January.

Canadian production currently is running at better than 20,000 units monthly the highest rate since 1937. Boosted by military orders, Canada's 1940 output of 222,984 units was the third highest on record, exceeded only by 1928 and 1929. The 1940 total was 43 per cent greater than 1939 and 112,388 vehicles, or 51 per cent of the total, were trucks. Truck production has exceeded passenger car output in Canada in every month since June.

Production in the U. S. and Canada for the week ending Feb. 8 was estimated at 122,000 units and this was expected to dip slightly in the succeeding week. General Motors produced approximately 51,600 units during the week, while Chrysler assembled 28,900 vehicles and Ford accounted for 26,100. Studebaker topped the independents, followed by Nash, Hudson and Packard.

Anticipation of higher Federal excise taxes and fear of a possible new car shortage spurred January retail sales. General Motors retail deliveries for the month totaled 168,168 units, establishing a 39 per cent lead over January a year ago. Nash registered a 51 per cent gain for the first 20 days, and Dodge truck sales for the first half climbed 36 per cent.

Meanwhile General Motors sales to U. S. dealers reached a total of 218,578 units during January, setting a new all-time high for any month in the company's history.

Used cars moved even better than new cars in many places during mid-January, exceeding sales for the same period of December, which is normally a better selling month. New passenger car inventories with U. S. dealers were estimated at 337,358 units as of Jan. 1, which is approximately a five weeks' supply.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

Expand Aircraft Parts Exhibition in Detroit

Air Defense Committee Puts Emphasis on Subcontracting; Orders of Automotive Industry May Reach Two Billions

In line with current efforts on the part of the Office of Production Management to step-up the rearmament program, a pursuit plane is to be added to the two bombers already on display at headquarters of the Automotive Committee for Air Defense at Detroit. Purpose of the display is to enable prospective suppliers to look over the parts in order to determine whether they have facilities to manufacture any of them. Arrangements have also been made for the showing of disassembled engines of both the air-cooled and liquid-cooled types.

It is well known that Pratt & Whitney now employs more than 300 subcontractors and farms out more than 60 per cent of its engine parts. Studebaker likewise expects to utilize subcontractors for about 60 per cent of the parts on its order for Wright aircraft engines.

Speaking of the subcontracting procedure, Clarence C. Carlton, director of the Automotive Committee for Air Defense and president of the Automotive Parts and Equipment Manufacturers, Inc., told the 600 persons present at the recent meeting of that association, that a questionnaire would be mailed to more than 1200 manufacturers with particular reference to facilities required in the manufacture of aircraft.

Mr. Carlton pointed out that the automotive parts manufacturers would furnish 78 per cent of the total man-hours required for building a complete bomber airframe in the program by which Ford, General Motors and Chrysler each will be responsible for wing and fuselage subassemblies for five bombers daily. The other 22 per cent of the man-hours will be expended in the final assembly plants at Omaha, Kansas City, Tulsa and Fort Worth.

As an example of the complexity of the task, Carlton cited the Consolidated B-24 bomber for which Ford will be responsible. This four-engined plane has a wing span of 110 feet, a length of approximately 63 feet and an overall height of 18 feet. Its gross weight is 40,000 pounds.

For an output of five bombers of each model daily, exclusive of engines, Carlton said the automotive industry would employ 858,000 man-hours per day, or 107,250 men on a single eight-hour shift basis. Should the daily production of parts be doubled, as it may well be by the time production begins, it would mean employment of 214,500 men.

He also told of the vast quantities of material that the bomber program calls for—137,500 pounds of aluminum daily and 42,200 pounds of steel per day. He said that more than 1200 men representing 800 concerns had visited the committee's exhibit and conferred with members of the technical staff. He asked for the utmost cooperation by the parts suppliers with the purchasing agents of the big companies who are responsible for the bomber program so that the work can be expedited with the most possible speed.

In summing up, Carlton said, "Defense work now is the No. 1 job of the automotive industry. Its contracts call for $1,400,000,000 worth of defense work. Before summer there may be $2,000,000,000 worth under way. . . . It is a great effort and a great responsibility. Upon this industry falls one-tenth of all the defense work contracted for by the Army and Navy. . . . It is indeed a pleasure to associate with an industry that has so willingly responded to the call of the nation in this endeavor."

The Brass-Hat Rack

"Miss Hobson, as soon as you get that soldier all fixed up warm, will you send out these letters?"

Machine Tools On Way To Ford Aircraft Engine Plant

Complete Structural Steel Work for Building Ahead of Schedule; Manufacturing Operations to Start in April

A total of 1540 machine tools will be required in the $21,000,000 Ford Motor Co. aircraft engine factory for the manufacture of Pratt & Whitney Double Wasp radial engines, according to the statement of Charles E. Sorensen, Ford production manager. Two hundred and fifty-seven of the tools were delivered during January and another 258 are due for delivery in February. Of the remainder, 260 are scheduled for delivery in March, 237 in April, 122 in May and the other 406 in smaller numbers through September.

The Ford organization will produce only a few smaller types of the machine tools, as most of them are being obtained from companies which specialize in building machine tools for aircraft engine production. The new factory will require 7484 machine fixtures.

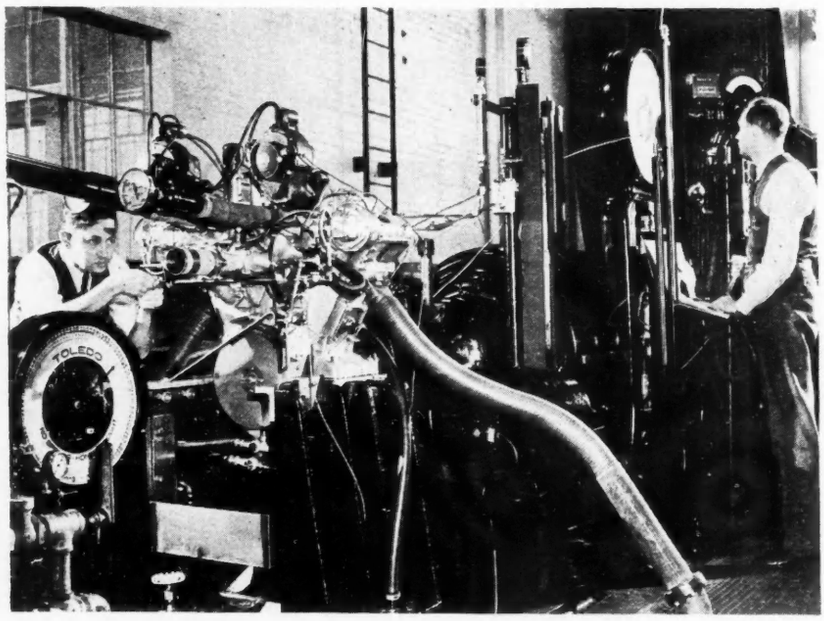
Structural steel work on the new aircraft engine building was completed Jan. 24, four days ahead of schedule, by the American Bridge Co. Ground was broken for the building last September and steel work was begun Nov. 24. The building, which measures 1000 by 360 feet, required 8791 tons of steel. To speed construction, a temporary shelter of tarpaper and 900,000 sq. ft. of fiber board was used to cover the building 10 feet outside the finished wall line to prevent any delays by bad weather. Brick laying and pouring of concrete is possible under this shelter at moderate temperatures through heat generated by huge charcoal braziers. The building is scheduled for completion late in March and manufacture of the first of the 4236 Pratt & Whitney engines on order by the government is due to start in April.

Brig.-Gen. Oliver P. Echols, chief of material for the U. S. Army Air Corps, and Dr. George J. Mead, aircraft engine expert for the OPM, inspected the Ford Rouge plant recently preparatory to the early manufacture of wing and fuselage parts for the Consolidated B-24 bomber as part of the program of the Automotive Committee for Air Defense. These parts are to be assembled in plants of the aircraft complany at Tulsa, Okla., and Fort Worth, Tex.

Ford later submitted an informal proposition to the War Dept. for the building of the complete bombers at an assembly plant to be built near Detroit. Brig.-Gen. Echols stated this proposition was still in the formative stage, while defense officials in Washington said that such a step would contravene the Army's policy of spreading out war industries as a cautionary measure rather than concentrating them in one area.

Ford has been awarded a $300,000 contract for sedans for use by Army officers, the War Dept. exercising an option under an original order for 1200 cars last Nov. 21. Previously, a low bid for 11,781 Army trucks was turned down by Ford after the War Dept. specified that the contract include a "labor clause" which requires a company to comply with the provisions of all federal, state and municipal labor statutes. The contract went to the next lowest bidder of the 155 who filed bids, the recipient being more than $250,000 higher that the Ford bid.

Ford refused the bid, according to I. A. Capizzi, Ford attorney, rather than risk cancellation of the contract by the government for any alleged violation of labor laws by one of the company's more than 87,000 workers.



"Mass Production" Airplane Engine

Laboratory testing the two-cylinder model of Henry Ford's own airplane engine is shown above. For details, see column three.

Ford 1700 Hp. Engine To Be Liquid Cooled

Aiming to develop an aircraft engine that lends itself to mass production, Ford engineers now are experimenting with a 12-cylinder, liquid-cooled model of the V-type, which is expected to develop 1500 to 1700 hp. It is a fuel injection type engine with an exhaust driven supercharger. A two-cylinder unit already has been tested for bearing loads, accessory drives, valve durability, horsepower output, oiling system and endurance. It is planned to have a completed engine ready for flight tests next summer.

Three Car Makers Add New Models to '41 Line

Six new models have recently been added to the Willys line for 1941. They include a Speedway coupe, billed as the world's lowest priced full-sized passenger car and carrying a list price of $595; a Speedway sedan, listing at $620; a station wagon at $820; a taxicab (price not announced); a pick-up truck at $575; and a cab-over-engine panel truck at $849. All prices are f.o.b. Toledo.

A new Oldsmobile four-door sedan, mounted on a 119-in. wheelbase chassis with either a six or eight cylinder engine, is slightly smaller than other Oldsmobile models and brings the company's "custom cruiser" styling to a lower priced field.

De Soto has announced a new seven-passenger model available in either sedan or limousine types. It is in reality a nine-passenger car since the front seat is unusually wide and auxiliary seats join closely at the center. Wheelbase is 139½ in. and overall length is 225¾ in.

Col. Eric Lubeck

Col. Eric M. Lubeck, veteran automobile sales executive, died Jan. 22 in Detroit after a 15-month illness. He was 64 years of age. At one time Col. Lubeck was sales manager of the Apperson Motor Co. and later sales manager of Oakland-Pontiac.

Deny Closing of Chicago Navy Pier to Conventions

Navy Pier in Chicago will not be closed to conventions and trade expositions, William J. Hennessy, convention bureau manager of the Chicago Association of Commerce, stated in denying reports that the Federal Government intends taking over Navy Pier. He said that there is no more likelihood of that being done than of taking over auditoriums in other cities. The Chicago exhibition hall was reconditioned at a cost of $300,000 previous to the Automotive Service Industries Show there in December when 350 ASI exhibitors and 1000 booths were accommodated on one floor.

Appoint MEMA Members On ASI Show Committee

A. H. Eichholz,, general manager of the Motor & Equipment Manufacturers Association, announces that at the recent board meeting of the association the following were appointed to represent the MEMA on the 1941 automotive service industries show joint operating committee: J. M. Spangler, National Carbon Co., chairman; R. D. Black, Black & Decker Mfg. Co.; C. P. Brewster, K-D Mfg. Co.; B. G. Close, King Quality Products Co.

The Motor & Equipment Wholesalers Association has already announced its appointments to the MEWA section of the committee. By annual rotation of the chairmanship, J. M. Spangler of the MEMA will be chairman of the joint committee.

CALENDAR

Conventions and Meetings

American Society for Testing Materials, Spring Meeting, Washington, D. C., Mar. 4-5

Society of Automotive Engineers, Aeronautical Meeting, Washington, D. C., Mar. 13-14

American Chemical Society, St. Louis, Apr. 7-11

Chamber of Commerce of the U.S.A. Annual Meeting, Washington, D.C., Apr. 29-May 1

Society of Automotive Engineers, Natl. Production Meeting, Milwaukee, May 12-13

Western Metal Exposition and Congress, Los Angeles .....May 19-23

American Battery Manufacturers Assoc., Detroit .....May 22-23

Society of Automotive Engineers, Summer Meeting, White Sulphur Springs, W. Va. .....June 1-6

American Society for Testing Materials, Annual Meeting, Chicago....June 23-27

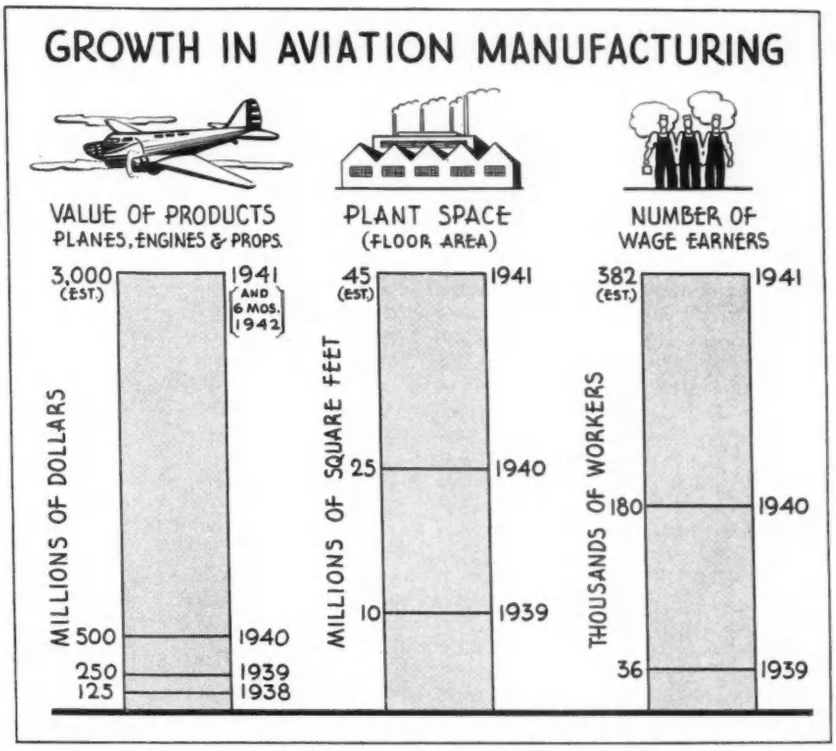
Society of Automotive Engineers, National Tractor Meeting, Milwaukee, Sept. 25-26

Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles .....Oct. 30-Nov. 1

Shows

National Automobile Trailer Show, Chicago .....Feb. 22-Mar. 2

Machine & Tool Progress Exhibition, Detroit .....Mar. 24-29



In a recent address, Col. John H. Jouett, president of the Aeronautical Chamber of Commerce, in referring to the growth of aviation manufacturing in the U. S., cited the interesting figures presented graphically above. These figures become more impressive when it is pointed out that they apply only to specialized aviation products plants and do not include the huge dollar volume of output, additional plant area and increased number of employes that will result from the operations of automobile manufacturers and others in carrying out their part of the defense aviation program.

Reo Adds Five New Heavy-Duty Models

The addition of five heavy duty truck models, ranging in gross vehicle weights from 17,000 to 35,000 lb. has been announced by Reo Motors, Inc., Lansing, Mich. Designation, gross vehicle weight in pounds and standard engine size in cubic inches of the various models are as follows:

Model	*Gross Weight*	*Displacement*
21H	17,000	288
22H	19,500	310
23H	22,000	381
23HH	26,000	404
23HHH	35,000	517

Engines are all of seven-bearing type with full-pressure lubrication and aluminum alloy pistons. Rear axles are available in spiral bevel, double reduction or two-speed double reduction types. Hydraulic brakes are standard with air brakes as an optional extra and sealed beam headlights are used.

Car Makers to Limit Use of Scarce Metals

Anticipating a request from the Office of Production Management, National Defense Advisory Commission, many of the automobile manufacturing companies have for a long time been studying the problem of using alternate material to replace and conserve scarce metals needed for munitions production. Preparations are under way to effect these substitutions as soon as model changes are made. Plans developed along this line are said to be so far advanced, according to a statement issued by Paul G. Hoffman, vice-president, Passenger Car Division, A.M.A., "that it is now possible to forecast release of very large quantities of special metals without delay, by voluntary action of the individual companies." "The full extent of such savings," Mr. Hoffman said, "will be determined in the near future."

Assurance is offered that performance, durability and appearance of the new vehicles will by no means be affected adversely. Furthermore, the changes to be made will not require extensive new tooling.

ADVERTISING

Campbell-Ewald Co., Detroit, this month is celebrating the thirtieth anniversary of its founding, which makes this advertising agency the oldest in Detroit and one of the few agencies in the country to have retained its corporate identity for that long.

Electric Auto-Lite Co. will make 16 awards to the safety directors of fleet winners in the National Truck Safety Contest which is scheduled to end July 31. Awards will be presented at the 1941 convention of the American Trucking Association.

Employment in Middle West Moves Upward at Fast Pace

Shortage of Skilled and Semi-skilled Workers Appearing in Michigan; Unions Intensify Efforts to Organize Ford

Reflecting the high rate of automotive production, industrial employment in the Detroit metropolitan area reached its highest point in more than three years when the Detroit Board of Commerce reported 420,000 workers on factory payrolls Jan. 31. Not since Nov. 15, 1937, has the industrial index reached such a peak. The Jan. 31 index compares to a 1940 high of 418,400 workers reached Nov. 15. Although automobile production is expected to slack off slightly later in the spring, increased activity in national defense orders is likely to lift employment to levels comparable with 1929 and 1937.

The Michigan Unemployment Compensation Commission reported a total of $69,369,386 in the commission's trust fund on Jan. 30, 58 per cent more than on the same date a year previous. Net benefit payments from the fund have totaled $104,901,811. The commission reported that 84 labor disputes in the state in 1940 resulted in unemployment for 29,446 workers.

Cleveland, site of many automotive parts plants, also reported employment at record levels during January, the industrial index of the Cleveland Chamber of Commerce reaching 112.4 during the month. This was the second best month in the 20-year history of the survey, exceeded only by August, 1929, when the figure was 112.9. Toledo reported a 10-year employment peak with 22,598 on industrial jobs in late January.

Employment in 68 Michigan automobile plants was up 8 per cent to 290,090 workers during December from the previous year, while in 42 parts plants employment increased 26 per cent. Average weekly earnings in the Michigan automobile industry were $39.33 in November and $37.76 in December, when overtime payments slacked off somewhat.

Widespread need for skilled and semi-skilled workers in Michigan factories was reported by the Michigan State Employment Service, although there is plenty of unskilled labor available. A survey by the state in December showed 62,403 registered unemployed in the Detroit area compared to 138,083 four months previously. However, of the December total, only 20,763 were registered as skilled or semi-skilled workers and of that number only 4606 were qualified for jobs in defense production. At present there is a shortage of plant layout men, tool designers, tool and die makers, milling machine operators, molders and screw machine operators.

Concurrent with the high employment rate, the UAW-CIO reported its membership at an all-time peak in December, with 356,644 dues-paying members on its rolls. This was more than double the total for December, 1939. In the six months ending last Oct. 31, the union took in $654,002 and had a balance on hand of $113,316 as of that date.

Pushing its drive for organization of the huge Ford Rouge plant, last citadel of the open shop in the automobile industry, the UAW-CIO ran into opposition from the UAW-AFL. William Green, president of the AFL, announced in Washington that the AFL had organized a "majority" of the 56,000 production workers in the Ford Rouge and Lincoln plants.

Harry Bennett, Ford personnel chief, said the company was ready to discuss grievances with AFL representatives, as it has in the past, but it would never sign a contract that would require individuals to pay for the privilege of working in the Ford plant.

At a meeting of defense leaders called in Lansing by Gov. Murray D. Van-Wagoner, Roy J. Thomas, president of the UAW-CIO, said the union was ready to do all in its power to stop production at the Ford Motor Co. if collective bargaining demands were not met, promising a strike if necessary.

Thomas sent a letter to the Ford Motor Co. Feb. 5 asking for an immediate collective bargaining conference and asking for a 10-cent an hour general wage increase, adjustment of wage rates and establishment of the seniority principle.

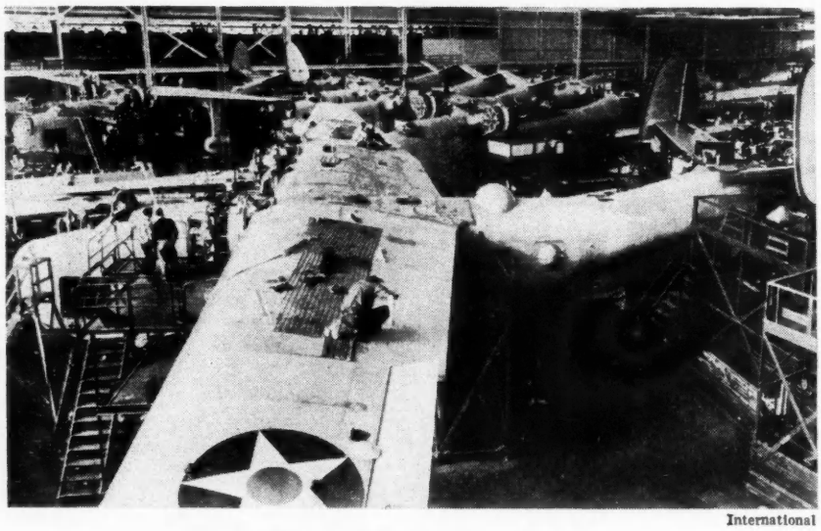
On Feb. 10, the U. S. Supreme Court refused to act on the appeal of the Ford Co. from the decision of the Circuit Court of Appeals ordering the reinstatement of 23 Ford workers discharged allegedly for poor workmanship and misconduct.

General Motors Contract

The International General Motors Council of the UAW-CIO in Detroit has voted to demand the following changes in the contract with General Motors: A general 10-cent an hour raise, union shop, two weeks' vacation pay instead of one week and more compensation for drafted workers than the 80 hours pay now in effect. The General Motors continuing contract requires 60 days' notice by either party before any proposed changes are discussed. General Motors payrolls in 1940 totaled $492,246,017, according to a corporation announcement, while the average income of hourly-rated workers was $1,804 compared to $1,503 in 1939.

The Detroit Transmission Division became the seventieth General Motors plant to give the UAW-CIO sole collective bargaining rights after an election in which the UAW received 1178 votes to 123 for no union. Strike threats were averted in two other GM plants. A discharged UAW-CIO committeeman was reinstated at the Chevrolet Division in Flint by decision of George W. Taylor, umpire under the GM-union contract. Authority to call a strike had been voted three weeks previously. An authorized strike at the Chevrolet forge, gear and bumper plant in Detroit failed to materialize when wage increases were granted 932 workers after negotiations.

The UAW-CIO won exclusive bargaining rights in the Evansville, Ind., assembly plant of the Chrysler Corp.



International

Hard Hitting Bombers for Navy

Heavily armed and armored defensively, these 20-ton PBM-1 bombers are designed for scouting far in advance of the fleet and also to strike a mighty blow to ward off attack. Glenn L. Martin Co. builds more than one a week at Baltimore for the Navy.

by a narrow margin, polling 344 votes to 332 for the UAW-AFL. This gives the UAW-CIO bargaining rights in 12 of 13 Chrysler plants, that at Kokomo, Ind., voting against any union. The UAW-CIO also won an NLRB election at the plant of the Stinson Aircraft Division of Vultee Aircraft, Inc., at Wayne, Mich.

Allis-Chalmers Strike

Demands for a closed shop by the UAW-CIO stalemated efforts by federal conciliators, including Msgr. Francis J. Haas, of Catholic University, to settle a strike called Jan. 23 at the Milwaukee plant of the Allis-Chalmers Mfg. Co. Wage increases and rehiring of 1000 discharged workers also were demanded by the union. The strike involved 7800 workers who had been employed on defense orders totaling $40,000,000 for propelling machinery for the U. S. Navy and machinery for duPont munition plants. The company accused the union of violating a collective bargaining agreement signed last May. Allis-Chalmers last Dec. 20 paid a bonus of 2 per cent on annual earnings, amounting to $500,000.

Strikes also hampered production at several plants of the International Harvester Co., which has $10,000,000 in defense orders. A strike closed the company's truck plant at Fort Wayne, Ind., early in January but ended with the signing of a contract with the UAW-CIO. A strike also closed the company's East Moline, Ill., plant for 10 days in a dispute between the Farm Equipment Workers Organizing Committee - CIO and an independent union. A 15-day truce finally was arranged Jan. 27 for the 1400 workers, during which grievances would be submitted to the company. The International plant at Rock Falls, Ill., went on strike Jan. 20, with the FEWOC and an independent union both making demands. The Chicago tractor plant was closed Jan. 29 by a walkout of 6500 workers, members of the FEWOC, who had voted to strike, 3,786 to 429, to enforce demands for collective bargaining and higher wages.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

The high level of business activity continues. The seasonally adjusted index of The New York *Times* for the week ended Jan. 25 stands at 123.6 per cent of the estimated normal, one fractional point below the figure for the preceding week, as against 107.4 a year ago. The unadjusted index of *The Journal of Commerce* for the same period rose to 116.0 per cent of the 1927-29 average, as compared with 114.9 for the preceding week and 101.4 for the similar period of last year.

Retail trade was well maintained last week, according to Dun & Bradstreet, with estimated sales averaging from eight to 12 per cent above corresponding 1940 figures. Department store sales during the week ended Jan. 25 were 12 per cent greater than a year ago, according to the Federal Reserve compilation, as against a similar gain of nine per cent for the preceding week.

Railway freight loadings increased more than seasonally during the week ended Jan. 25, totaling 710,752 cars, as against 703,497 cars in the preceding week and 650,187 cars in the comparable period last year.

Electric power production in the same week was 10.3 per cent greater than a year ago; the similar gain for the week before was 10.6 per cent.

Bank debits to deposit accounts, except inter-bank accounts, in leading cities for the week ended Jan. 29 were six per cent larger than a year ago. The total for the 13-week period ended on that date is 10 per cent above that a year earlier.

Commercial and industrial failures during the week ended Jan. 30, according to Dun & Bradstreet, numbered 300, as against 307 in the preceding week and 285 in the corresponding period last year.

Crude oil production for the week ended Jan. 25 averaged 3,599,100 barrels daily, showing a decline of 12,800 barrels from the average for the week before but exceeding by 8,100 barrels current requirements as computed by the Bureau of Mines.

Cotton mill activity declined seasonally in the same period, The New York *Times* adjusted index remaining unchanged at 167.9 per cent of the estimated normal, as against 118.6 a year ago.

Professor Fisher's index of wholesale commodity prices for the final week of January stands at 85.7 per cent of the 1926 average, as against 86.1 in each of the preceding two weeks.

Member bank reserve balances declined $63,000,000 during the week ended Jan. 29, and estimated excess reserves declined by nearly the same amount to $6,800,000,000. Business loans of the reporting members showed a further expansion of $21,000,000, to stand at $5,076,000,000, or $781,000,000 more than the comparable total last year.

Machine Tool Orders May Reach $750,000,000 Mark

Machine tool production for 1941 will total $750,000,000, an increase of $300,000,000 over 1940 and $100,000,000 greater than preliminary estimates for 1941, it is announced by Clayton R. Burt, chairman of the defense committee of the National Machine Tool Builders' Association, following an industry-wide study of ways and means to accelerate production.

"In view of the mounting requirements for national defense," Burt said, "the nation's machine tool builders have conducted an exhaustive survey of methods and facilities in an effort to put into immediate use every possible means to increase output."

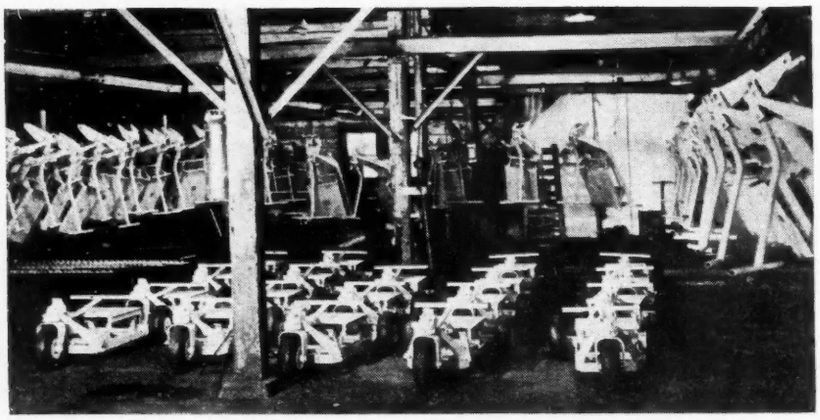
C. R. Messinger

C. R. Messinger, president of the Chain Belt Co. and Oliver Farm Equipment Co., died Feb. 4 at his Milwaukee home following a heart attack. He had been active in the industrial phase of the national defense as a member of the advisory council of the U. S. Army ordnance department for the Midwest.

New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	DECEMBER				TWELVE MONTHS				DECEMBER				TWELVE MONTHS			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939
Chevrolet, Ford and Plymouth	178,626	126,979	53.48	51.51	1,835,566	1,428,644	53.81	53.86	$146,306,000	$96,900,000	47.25	44.76	$1,428,864,000	$1,056,600,000	47.43	46.54
Others under $1,000	59,477	83,950	17.81	34.05	956,972	940,053	28.05	35.44	55,060,000	76,300,000	17.78	35.24	868,507,000	858,500,000	28.83	37.82
$1,001 to $1,500	89,647	32,796	26.84	13.31	585,855	246,743	17.18	9.30	97,201,000	37,700,000	31.39	17.41	653,552,000	285,700,000	21.70	12.59
$1,501 to $2,000	4,761	1,828	1.43	.74	23,413	24,569	.69	.93	7,527,000	3,200,000	2.43	1.48	38,788,000	38,800,000	1.29	1.71
$2,001 to $3,000	1,460	946	.44	.38	9,161	11,953	.27	.45	3,481,000	2,300,000	1.12	1.08	22,070,000	27,300,000	.73	1.20
$3,001 and over	16	21	.....	.01	100	697	.....	.02	79,000	100,000	.03	.05	479,000	3,100,000	.02	.14
Total	333,987	246,520	100.00	100.00	3,411,067	2,652,659	100.00	100.00	$309,654,000	$216,500,000	100.00	100.00	$3,012,060,000	$2,270,000,000	100.00	100.00
Miscellaneous	86	24	.....	.....	4,838	718	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	334,073	246,544	100.00	100.00	3,415,905	2,653,377	100.00	100.00	$309,654,000	$216,500,000	100.00	100.00	$3,012,060,000	$2,270,000,000	100.00	100.00

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.



First Ride for Bombs

To make bomb handling safer and easier, the Government has ordered 600 rubber-tired scooters from Weaver Mfg. Co. Equipped with a hydraulic lifting mechanism, they are made from standard rolled steel parts, arc-welded by a process developed in conjunction with the Lincoln Electric Co.

Trend in Steel Prices Dependent on Wage Scale

Output of Steel Believed on Par with Consumption; Expect Tungsten Shipments Will Relieve Shortage

With the time approaching when in ordinary years announcement of second quarter steel prices would be forthcoming, consumers interpreted as reassuring the remarks of a prominent steel company executive regarding the outlook, if wage scales can be held in check. That the latter problem will exert more and more influence on the market's course is the opinion of leading steel consumers as well as producers. But great as is the uncertainty of its final solution, the opinion prevails that, so far as concerns second quarter prices, they will remain as at present. There are those who see in the microscopic decrease in the ingot operating rate for the week ended Feb. 8, which the American Iron & Steel Institute estimates at 96.9 per cent of capacity compared with 97.1 per cent in the preceding week, an indication that tension is lessening.

Although a majority of mills continue to report booking fresh orders in excess of shipments, the steel output is now thought by many to be keeping pace with actual consumption. In this connection it is pointed out that considerable capacity continues to be added through the remodeling of old furnaces and other equipment. Capacity expansion as the result of such improvements and technical progress in the stepping up of per unit output without too much strain on equipment appear to be general. Everywhere there is evidence that the steel industry means to prove by performance that there is no need of wholesale additions to basic capacity, which would only consume man power more urgently needed elsewhere.

Automobile manufacturers are taking heavy tonnages of body stock and other descriptions of steel in proportion, but virtually all of this material is intended for nearby assemblies. Conditions in the steel industry being what they are, some automotive consumers anticipate their requirements a little more than they did formerly, but on the whole purchasing methods have undergone little change.

The shortage in tungsten, which the Navy relieved to some extent by making available its reserve of the metallic element, is expected to be overcome through the arrival of fresh supplies now on their way to the United States.

An increase of 25 per cent in ocean freight rates on tin from the Far East, which raised import costs by about 40 cents per 100 pounds, caused the market for spot Straits to advance about that much, but inquiry being virtually nil, the price tapered off. Importers say they can not make any profit when they sell Straits tin on the basis of the price paid by the Government and consumers are generally unwilling to pay a premium. Spot Straits tin is quoted at 50.35 cents.

With announcement of a further purchase of 100,000 tons of Latin American copper by the Government's Metal Reserve Company, consumers have little trouble in getting what they need in the outside market at 12½ cents even when unable to obtain copper from the producers, who continue to quote electrolytic at 12 cents a pound.

Hoarding of aluminum scrap came in for severe censure by the Defense Commission's price division, and more drastic measures to curb speculative holders are contemplated.—W. C. H.

CENSORED—

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, M. W. Bourdon.

The National Safety First Association has changed its name to the Royal Society for the Prevention of Accidents. At an emergency meeting held for the purpose Colonel Pickard, the secretary, gave as the reason for the change that the original meaning of the expression "safety first" had been distorted in a selfish sense that was entirely inappropriate to prevailing conditions and spirit of the country.

* * *

An hydraulic remote control system for gear shifting on buses and trucks has been devised by the New Hudson Co., manufacturers of Girling brakes. The hand lever in each of its operative positions takes effect upon double-ended pistons; by this means fluid is displaced from one cylinder of an output unit while an equal volume is drawn into the opposite cylinder. Hydraulic pressure is conveyed through flexible tubing to an input unit in the four-speed and reverse gear set and moves the striking fork selected by the position of the gear lever.

* * *

A conference of affiliated organizations has been called by the Public Transport Association to discuss the lack of supplies of new buses and to frame an appeal to the Ministries of Transport and Supply. What is described as "a very serious position" has arisen as a result of the ban upon the sale and purchase of new vehicles, except under permit, and emphasis is placed on the fact that even the possession of a permit, difficult as it is to obtain, is no guarantee that any manufacturer will be able to supply even one vehicle of the kind required, if any kind at all.

* * *

The death of Lord Wakefield has been recorded at the age of 81 years. Governing director of C. C. Wakefield & Co., famed as the producers of "Castrol" lubricants, Lord Wakefield will long be remembered for the valuable assistance he gave to aeronautics and to the obtaining for Britain of world's records in the air and on land and water. He was extremely generous in his donations, giving over £1,000,000 in all to scientific research, hospitals, museums and various charitable institutions. He was twice president of the Motor Trade Benevolent Fund.

* * *

To encourage the use of coal tar oils (creosote is particularly mentioned) in addition to or in place of imported motor fuels, the Govern-

From Britain

ment has put into effect a scheme whereby users of such oils will be granted additional ration coupons to enable them to cover more mileage with their vehicles on essential journeys.

* * *

Annual reports and balance sheets that have been issued of late by half a dozen retail motor trading companies, mainly garage firms and new car distributors, give evidence that resource, enterprise and adaptability to changed conditions have enabled them to survive the change-over from peace to war and even, in one case, to pay a larger dividend to shareholders. It is anticipated that, although new car sales are banned, 1941 will be a year of abnormal activity in repair and maintenance departments, and that these operations, combined with used car transactions, are capable of yielding a reasonable profit on the year's working.

* * *

In one London district, Hammersmith, the local authorities have been making experiments with a special luminous paint for the guidance of pedestrians and drivers during the nightly blackouts. Public lamp standards by the roadsides have been coated with it and have been found to provide a white glow visible 60 feet away.

* * *

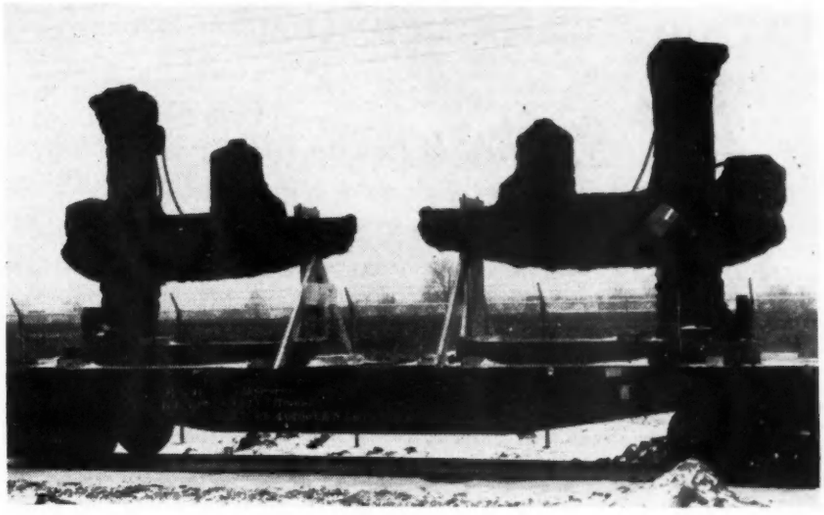
Road fatalities continue to increase. The latest returns, applying to December, show that over 1300 deaths occurred during the month, a substantial increase upon both the previous month and the figure for December, 1939. The blackout was not accountable to the same extent as previously, for the biggest increase in deaths, nearly 100 per cent, occurred during daylight.

* * *

Employes at the Wolseley car plant have their own air raid insurance fund. Each adult pays one shilling per week (juniors six pence), and any subscriber whose home suffers damage by enemy action is entitled to claim up to £20 (juniors £10). The company started the fund with a contribution of £500 and is adding £1 to every £1 subscribed by employes up to a maximum of £1500.

* * *

The makers of the David Brown farm tractor have introduced a hydraulically operated attachment for use when the plow is rigidly attached to the tractor. Its purpose is to maintain a uniform depth of furrow irrespective of irregularities of the land.



Presses—Not Dinosaurs

These giant drill presses are among the first machines to arrive at the new Chrysler Tank Arsenal. One-third of the building was virtually completed by Feb. 10 and was being temporarily heated by a railroad locomotive. The 6500-ton steel contract for the entire building had already been finished by Bethlehem Steel Co.

APEM Organizes Aviation Division; Elects Officers

Establishment of an aviation division by the Automotive Parts & Equipment Manufacturers was announced by General Manager Frank Rising at the annual meeting of the organization in Detroit. This addition was decided upon after a survey showed that 73 member companies are making aviation parts. Eighteen companies joined the association during the past year, bringing the total membership to a point where it covers 375 plants.

At the annual election, Clarence C. Carlton was elected to his ninth consecutive term as president. L. D. Adams, vice-president of Barnes-Gibson-Raymond Division of Associated Spring Corp., was elected executive vice-president, while F. C. Crawford, president of Thompson Products, was named production vice-president in charge of aviation. B. F. Hopkins, president of Cleveland Graphite Bronze Co., was re-elected secretary and S. D. Den Uyl, secretary-treasurer of Bohn-Aluminum & Brass Corp., was elected treasurer. New directors named to two-year terms were Byron A. Fay, vice-president of Electric Auto-Lite Co., Neil A. Moore, vice-president of Sealed Power Corp., and Willard F. Rockwell, chairman of Timken-Detroit Axle Co.

Black & Decker Statement

In its 30th annual statement, the Black & Decker Mfg. Co., Towson, Md., reports consolidated net sales of $6,976,023 as of Sept. 30, 1940, as compared to $5,346,364 for the previous year, an increase of 30.5 per cent. The net earnings for the past year amounted to $1,065,095, or earnings of approximately $2.82 per share as compared with net earnings of $1.60 per share for the preceding year.

Passenger Car and Truck Production

(U. S. and Canada)

	December 1940	November 1940	December 1939	TWELVE MONTHS 1940	TWELVE MONTHS 1939	TWELVE MONTHS Per Cent Change
Passenger Cars—U. S. and Canada:						
Domestic Market—U. S.	386,729	395,860	357,712	3,584,293	2,702,181	+32.7
Foreign Market—U. S.	9,802	11,231	16,092	108,035	164,615	−34.3
Canada	11,653	10,814	11,054	110,126	108,369	+ 1.6
Total	408,184	417,905	384,858	3,802,454	2,975,165	+28.0
Trucks—U. S. and Canada:						
Domestic Market—U. S.	73,484	68,223	60,650	655,638	558,973	+17.2
Foreign Market—U. S.	13,552	12,038	17,688	121,388	151,523	−20.0
Canada	11,711	12,807	5,922	112,858	47,057	+140.0
Total	98,747	93,068	84,260	889,884	757,553	+17.2
Total—Domestic Market—U. S.	460,213	464,083	418,362	4,239,931	3,261,154	+29.8
Total—Foreign Market—U. S.	23,354	23,269	33,780	229,423	316,138	−27.5
Total—Canada	23,364	23,621	16,976	222,984	155,426	+43.2
Total—Cars and Trucks—U. S. and Canada	506,931	510,973	469,118	4,692,338	3,732,718	+25.7

Hudson Gets Subcontract To Build Airplane Parts

Forms Aircraft Division to Handle This Phase of Defense Work; Recent Orders to Auto Companies Over $33,000,000

Hudson Motor Car Co. joined the growing list of automobile companies engaged in aircraft work when its new aircraft division announced receipt of a subcontract for ailerons for a large eastern airplane builder. Hudson has facilities for production of wings and ailerons in its Detroit plant, according to President A. E. Barit. George Goin, an experienced aviation engineer, is plant manager of the aircraft division.

Meanwhile, condemnation proceedings are under way for acquisition of 114 acres of land in Macomb County, northeast of Detroit and only a few miles from the new Chrysler Tank Arsenal, where Hudson will erect a $12,000,000 ordnance plant for the Navy Dept. About 3600 men will be employed in the plant, which will manufacture parts for gun mounts and torpedo tubes.

Recent defense orders to automotive plants include $8,296,493 to Chevrolet for 1½-ton Army trucks; $10,715,019 to Continental Motors Corp. for aircraft engines for training planes; $2,415,000 to Budd Wheel Co. for shell casings; $436,680 to Michigan Tool Co. for worm gear units; $4,465,040 to Fruehauf Trailer Co. for trailers; $737,154 to Diamond T Motor Car Co. for 4-ton Army trucks; $703,500 to Lavine Gear Co., Milwaukee, for 1-ton trailers; $923,504 to Goodyear Tire & Rubber Co. for aircraft wheel and brake assemblies; $908,423 to Federal Motor Truck Co. for truck-tractors; $120,131 to Timken-Detroit Axle Co. for artillery ammunition; $279,788 to Bender Body Co., Elyria, Ohio, for tilt-type trailers; $346,080 to Biederman Motors Corp., Cincinnati, for truck-tractors; $668,546 to International Harvester Co. for Army trucks; $497,880 to Trailer Co. of Americal for semi-traillers; $114,975 to National Stamping Co. for angle tubes; $1,239,000 to Kelsey-Hayes Wheel Co. for ammunition components; $216,383 to Mueller Brass Co., Port Huron, Mich., for naval rolled brass, and $216,383 to Thorrez & Maes Mfg. Co., Jackson, for steel bodies.

Hillman Minimizes Defense Strike Effects

Sidney Hillman, associate director general of the Office of Production Management, early this month sought to minimize the extent of strikes and industrial disputes under the defense program, emphasizing that of the total working time for the year 1940 less than two hours per worker were lost because of strikes. He said this was less than one-fourth of the loss due to industrial accidents in the same period.

Mr. Hillman quoted from a special study made at his request by the Bureau of Labor Statistics to back up his statement that "beyond question harmony prevails in employer-employe relations." The study showed that out of 300 threatened disputes arising since the advent of the defense program "only a handful resulted in appreciable stoppages." All of these were described as being of short duration.

Reviewing the period during which the extent of strikes and industrial disputes has prompted Congressional quarters to discuss the desirability of strike-curbing legislation, the study showed:

1. That work stoppages due to strikes in American industry during the year of 1940 accounted for an average loss of less than a quarter of a day per year per worker.

2. That on-the-job accidents accounted for an average idleness of more than one day per worker, or upwards of four times that due to strikes. The figure for accidents was said to omit "the tremendous loss resulting from more than 11,000 deaths."

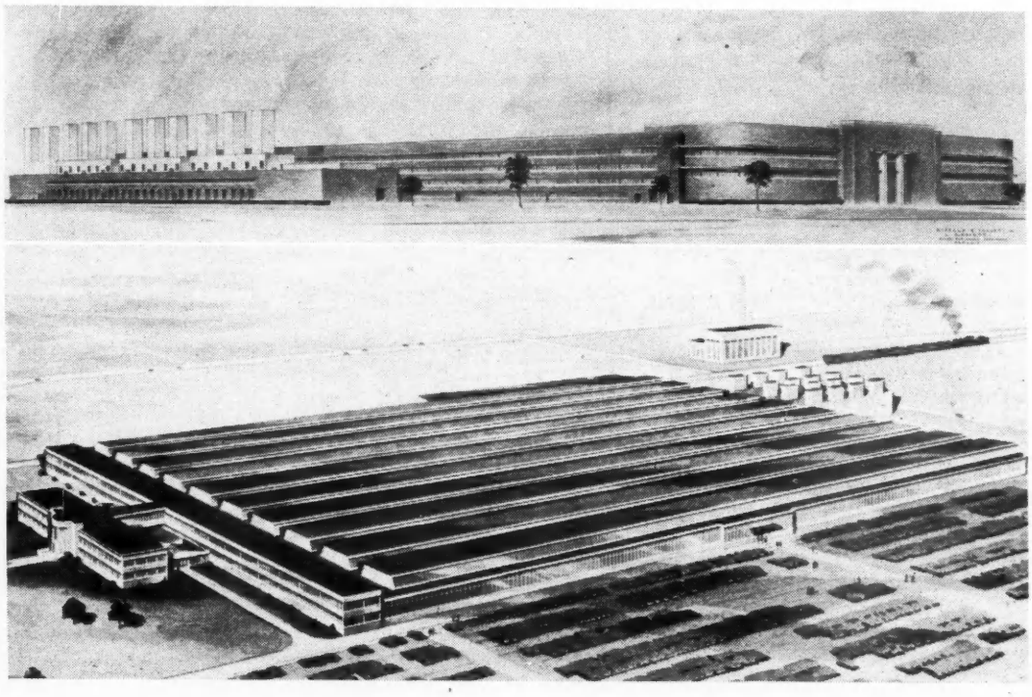
3. That the number of man-days idle due to strikes was only half as great during the first six months of the defense program as in the corresponding period for 1939.

4. That the number of men involved in strikes was 47 per cent less during the first six months of the defense program than when the United States was actually at war 24 years ago. The report called these figures "all the more significant when it is realized that total non-agricultural employment is 22 per cent greater today than in 1917."

In contrast to Mr. Hillman's optimism, defense officials manifest growing concern over the labor situation. Not only do they point to stoppages of work on vital military production that have already taken place but they are also disturbed over wage increase demands that are expected to be made shortly in important defense industries, such as steel, and over the demand of railroad labor for two weeks' vacation with pay. Ballots to vote on the question of striking to enforce this railroad demand have been sent out.

Aircraft Engine Plants

Pratt & Whitney aircraft engines will soon be rolling off the assembly lines of these new Ford (top) and Buick plants. The architects' drawings give a good idea of the size of the undertaking required to make mass production a reality. Construction on the Ford building, running slightly ahead of schedule, is expected to be completed by the end of March.



New Plan Speeds Adoption Of "Emergency" Standards

The American Standards Association has adopted a special streamlined method for obtaining quick action in developing emergency standards needed for defense purposes.

The emergency procedure will empower special committees to act for the association in starting new work, appointing technical committees, and in approving emergency standards. These emergency standards will be published in a distinctive format that cannot be confused with regular American standards.

After the emergency has passed, the newly-adopted procedure provides that "the defense emergency standards will be reviewed by the appropriate committees, and approved, amended, or withdrawn, through the regular procedures of the association."

Among the defense jobs on which the American Standards Association is already working are: tool steels, screw threads, bolts and nuts and wrench head openings, machine pins, wire and sheet metal gages, mechanical fits, statistical methods of quality control in mass production. Many of its safety code projects are also important in providing protection for workmen on defense production jobs.

Puerto Rico Shipments

Sales of passenger cars and trucks to Puerto Rico broke all records during 1940, having increased 60 per cent over the preceding year, according to the Puerto Rican Trade Council. The island purchased 5061 units valued at $3,750,000. Truck shipments totaled 1333 units.

Exports and Imports of the Automotive Industry

United States exports of automotive products during December had a valuation of $26,263,648 as compared with $28,894,555 in November and $25,664,629 for the closing month of 1939, according to the Motive Products Division, Department of Commerce.

Shipments included 7569 passenger cars valued at $5,339,674; 10,201 trucks valued at $8,534,866, and miscellaneous products having a valuation of $12,389,108. The corresponding figures for November were 9346 cars valued at $6,407,791; 10,386 trucks at $10,316,097, and miscellaneous items valued at $12,170,667.

The Union of South Africa, Mexico, Canada, Brazil and Cuba were the leading markets for passenger vehicles, while the United Kingdom, British India, Union of South Africa, Netherlands Indies, and the Belgian Congo were the chief countries of destination for commercial units, from the standpoint of value.

Parts for assembly, automobile engines, and motorcycles recorded an improved demand during December, with other items in the general group holding close to the totals for the previous months' requirements. The tabulation of exports and imports follows:

	DECEMBER 1939		DECEMBER 1940		TWELVE MONTHS ENDED DECEMBER 1939		1940	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 24,826,344		$ 24,469,743		$ 253,722,384		$ 254,307,811
PASSENGER CARS								
Passenger cars and chassis	11,744	7,506,838	7,569	5,339,674	137,866	84,658,401	88,806	57,253,737
Low price range $850 inclusive	10,107	5,786,486	6,770	3,553,886	122,444	68,359,398	76,670	44,753,190
Medium price range over $850 to $1200	1,363	1,311,684	1,578	1,450,370	13,008	12,399,486	10,567	9,989,458
$1200 to $2000	254	364,352	201	286,043	2,057	2,968,351	1,390	1,992,036
Over $2000	20	44,316	20	490,375	357	931,166	179	519,224
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	10,782	6,340,751	10,201	8,534,866	114,665	69,504,614	103,713	88,201,907
Under one ton	1,433	596,507	518	207,918	17,020	7,081,135	11,942	5,505,177
One and up to 1½ tons	7,827	3,771,155	7,840	3,840,686	80,843	42,907,398	70,860	38,216,570
Over 1½ tons to 2½ tons	1,102	1,033,281	458	503,072	12,106	10,764,716	11,205	13,789,471
Over 2½ tons	415	932,875	1,377	3,906,936	4,060	8,160,694	9,452	30,355,859
Bus chassis	5	6,943	8	13,254	636	590,671	254	334,830
PARTS, ETC.								
Parts except engines and tires								
Automobile unit assemblies		5,322,241		6,270,270		43,462,976		55,166,104
Automobile parts for replacement (n.e.s.)		3,952,156		2,984,058		39,731,171		38,350,633
Other automobile accessories (n.e.s.)		397,491		504,672		4,267,391		5,306,062
Automobile service appliances		51,277		742,263		1,485,128		4,038,176
Airplanes, seaplanes and other aircraft (powered)	294	21,000,157	366	18,032,151	1,219	66,386,736	3,451	192,910,760
Parts of airplanes, except engines and tires (n.e.s.)		28,893,811		2,816,351		116,910,348		27,467,394
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel (other than automotive)	139	463,728	158	273,412	641	2,452,485	1,092	3,168,094
Other stationary and portable								
Not over 10 hp.	1,727	87,884	1,753	97,811	16,018	896,157	15,285	878,593
Over 10 hp.	374	229,586	194	507,567	2,429	1,450,935	2,377	3,741,683
Engines for:								
Motor trucks and buses	3,047	418,448	877	168,769	28,361	3,428,109	17,596	2,116,466
Passenger cars	2,871	321,934	1,754	213,818	26,075	2,399,779	15,965	1,548,509
Aircraft	382	3,467,105	559	6,766,373	1,880	14,120,035	4,986	49,873,823
Accessories and parts (carburetors)		280,988		472,939		2,955,851		4,843,516
IMPORTS								
Automobiles (dutiable)	67	72,601	27	22,274	639	520,199	561	544,603

PUBLICATIONS

Westinghouse Lamp Division has issued a new **Drying Lamp** booklet on the use of radiant heat lamps in industrial drying, baking and heating.*

Cullen-Friestedt Co. has issued an informative circular (No. W-P20) on **Welding Positioners.** It deals with the factors involved in the handling of weldments of all sizes and shapes, and has many illustrations showing the use of positioners. The complete line of C-F Positioners is described.*

Pratt & Whitney division Niles-Bement-Pond Co. has issued the following circulars: (1) **Deep Hole Driller** No. 1½ for drilling long true holes up to 2" diameter; (2) **Gun Barrel Chambering Machine** No. ½B, which performs the complete precision operation of chambering a gun barrel to receive the cartridge; (3) **Deep Hole Reamers,** No. ½B and No. 1B, designed primarily for reaming rifle barrels; (4) **Deep Hole Drillers** No. ½B and No. 1B, designed for handling a wide range of work, including rifle barrels, automotive connecting rods, hollow spindles, camshafts, wrist pins, etc.; (5) **Deep Hole Drill Sharpener,** designed to sharpen drill's with from 3/16" to ⅝" diameters inclusive; (6) **Gun Barrel Rifling Machines** No. ½B—No. 1B, designed to meet modern production requirements in speed and accuracy.

Century Electric Co. has issued two circulars, one describing and illustrating its **capacitor single phase motors** up to 20 hp. and the other describing and illustrating its **totally enclosed fan cooled squirrel cage induction motors.***

Southwark Hyspeed Hydraulic Presses are described and profusely illustrated in an attractive booklet issued by the Baldwin Southwark division of the Baldwin Locomotive Works.*

Link-Belt Co. has a new illustrated folder No. 1894 giving information on **3/16" pitch Silverstreak silent chain drives** for fractional horsepower duty.*

The January issue of Tool Tips, published by Ex-Cell-O Corp., contains an interesting article on **Internal Thread Grinding.***

A new bulletin on **Sylphon Shaft Seals** has just been issued by Fulton Sylphon Co. It contains specifications, dimensions, operating characteristics, etc., and other useful information for designers and manufacturers.*

American Society for Testing Materials has issued a new book A.S.T.M. Standards on Rubber Products. Copies may be obtained from the society at 260 S. Broad St., Phila., at $1.75 per copy.

National Machine Tool Builders Assoc. has just released a booklet called **Machine Tools,** which tells how the nation's machine tool industry is turning out lathes, milling machines, boring mills, planers and other types of machine tools for the U. S. Defense Program.*

Hercules Motors Corp. has issued a booklet, **Hercules Power Units,** which describes and illustrates a wide and inclusive range of types and sizes. The booklet also includes specifications, power charts and other information covering the most popular types and sizes of Hercules standard power units.*

Atlas Press Co. has issued a new 72-page catalog of Atlas machine tools and shop equipment, which includes complete information on 1941 models of Atlas **lathes, drill presses, arbor presses and shapers** and announces two new machines, a compact bench miller and a multiple spindle drilling machine.*

The Heil Co. has a new catalog of **transportation tank equipment.***

Cardox Corp. has issued an attractive booklet on **Cardox Fire Extinguishing Systems.** The booklet is illustrated and fully describes the Cardox system of fire fighting.*

Jessop Steel Co. has issued a folder describing their **Top Notch shock resisting tool steel.** It contains information on the correct heat treatment of Top Notch.*

(*Turn to page* 188, *please*)

Parts Their Part for Defense

Government experts and automobile officials conferred on defense subcontracts at annual dinner of Automotive Parts & Equipment Mfrs. in Detroit. Shown above left to right: O. E. Hunt, General Motors Vice Pres.; Major General Geo. H. Brett, Chief of Army Air Corps; M. M. Gilman, President of Packard; Dr. Geo. Mead, OPM expert.

Plant Extensions and Factory Enlargements

Studebaker Corp. has purchased a 50-acre tract of land at Archer and Cicero Aves., Chicago, to be used as the site for one of its new aircraft engine plants. Others will be located at Fort Wayne and South Bend, Ind. Employment in all three is expected to reach 9400.

Willys-Overland Motors, Inc., Toledo, has leased 854,000 sq. ft. of its unused floor space to the War Department for use as a medical supply and distributing center.

Hupp Motor Car Corp., Detroit, which is in the process of reorganization, has sold Plant No. 22 on Mt. Elliott Ave. to Gar Wood Industries, Inc., at a reported price of $75,000. The latter company will use the 80,000 sq. ft. for the manufacture of gun mountings. Hupp has also leased considerable space to U. S. Rubber Co., Chrysler Corp. for storage purposes.

Carnegie-Illinois Steel Co. has placed a battery of 71 new by-product coke ovens in operation at its Gary, Ind., plant. The new batteries raised to 1258 the number of coke ovens now operating in the Chicago area.

Allegheny Ludlum Steel Corp., Pittsburgh, is enlarging its capacity for melting special alloy steels to 4000 tons per month, according to a recent announcement.

Borg-Warner Corp has completed a $100,000 addition to its Calumet Steel Division at Chicago Heights. The new building will double the company's capacity for steel tubing.

Clark Equipment Co., Chicago, has announced plans for a $2,500,000 plant expansion and equipment program to handle government orders for truck housings and transmissions for army use.

Sterling Engine Co., Buffalo, N. Y., is planning a $500,000 plant addition to take care of increasing Government and private orders.

A plant expansion program involving new facilities to the extent of $2,000,000 has been approved by the board of directors of Cleveland Graphite Bronze Co., Cleveland. Extensive plans for the development of new research activities in the aircraft field were also announced.

Hercules Motors Corp., Canton, Ohio, has purchased a four-story building formerly occupied by the York Ice Machinery Corp. The building adjoins the main Hercules plant at Canton and will be used to expand production facilities.

The Wesson Co., Detroit tool manufacturing concern, has broken ground for an ultra modern one-story plant at Ferndale, Mich.

A three-story building at Polk and Laflin Sts., Chicago, has been purchased by the Badger Tool & Mfg. Co., of that city, to take care of increased production of automobile parts and accessories.

Bakewell Mfg. Co., Los Angeles, has purchased a factory building in that city for manufacturing machine tools used principally by aircraft manufacturers.

The third addition in 18 months to the Monarch Machine Tool Co. plant at Sidney, Ohio, an expansion that will increase its employment on the production of lathes for the defense program another 40 per cent, will be a one-story structure having 25,000 sq. ft. of floor space. Land and building will cost $150,000 and new equipment $500,000 additional.

Verson Allsteel Press Co., Chicago, has started a $365,000 improvement program designed to increase production by 40 per cent. An additional $65,000 will be used to enlarge its plant.

Milled Screw Products Co., Chicago, is planning building an addition of 60,000 sq. ft. of floor space to handle defense contracts.

Chicago Flexible Shaft Co. is adding three stories to its present three-story plant, increasing its warehouse space by 55,000 sq. ft. to a total of 250,000 sq. ft.

Logan Engineering Co., Chicago, is adding 25,000 sq. ft. of floor space to its manufacturing facilities to handle a subcontract for the supplying of small lathes to be used in the new Studebaker airplane engine plant, which is to be built soon in Chicago.

Estimated Dealer Stocks of New Passenger Cars

1939	July	August	September	October	November	December
Production—U. S. Domestic Market †	142,346	56,245	155,430	239,150	272,747	357,712
Retail Sales—U. S. ‡	229,873	166,172	139,222	236,584	257,398	274,233
Change in Inventory	−87,527	−109,927	+16,208	+2,566	+15,349	+83,479
Inventory, First of Month	295,708	208,181	98,254	114,462	117,028	132,377
1940	**January**	**February**	**March**	**April**	**May**	**June**
Production—U. S. Domestic Market †	348,755	324,555	341,634	351,814	315,441	276,949
Retail Sales—U. S. ‡	239,509	236,857	338,153	353,423	330,521	350,671
Change in Inventory	+109,246	+87,698	+3,481	−1,609	−15,030	−73,922
Inventory, First of Month	215,856	325,102	412,800	416,281	414,672	398,592
1940 (continued)	**July**	**August**	**September**	**October**	**November**	**December**
Production—U. S. Domestic Market †	165,672	45,172	220,696	411,016	395,860	386,729
Retail Sales—U. S. ‡	298,683	177,679	158,033	326,097	334,536	317,379
Change in Inventory	−133,011	−132,507	+62,613	+84,919	+61,324	−69,350
Inventory, First or Month	324,670	191,659	59,152	121,765	206,684	268,008

†—U. S. Census Bureau. ‡—Automobile Manufacturers Association.
Inventory January 1, 1941, was 337,358.

AERA Questionnaire

To determine possible facilities for servicing Government motorized equipment in an emergency, the Automotive Engine Rebuilders Association has sent a questionnaire to its members regarding their machine shop equipment and mechanic personnel. From the returns a study will be made as to the amount of assistance that can be extended to the Government in connection with the defense program.

MEN . . . . . .

Ralph J. Archer has been appointed general sales manager of Willys-Overland Motors, Inc., in charge of domestic and export sales. His assisant sales managers are **G. H. Bell,** in charge of domestic sales, and **J. W. Truitt** to head the export division. **Arthur Stanton** was named sales promotion manager.

A. R. Boscow, assistant to the general sales manager for Nash Motors Division of Nash-Kelvinator Corp., has been promoted to the post of fleet sales manager. **H. G. Little,** advertising executive of the Lord & Thomas Agency and more recently Cincinnati manager of Roy S. Durstine, Inc., has been named Nash advertising manager.

Carl H. Vaupel, formerly sales manager of the Aircraft & Diesel Corp., Chicago, is now assistant to the president and general manager of the Cooper-Bessemer Corp., Mt. Vernon, Ohio.

H. H. Budd has been named plant manager of the aircraft division of the Briggs Mfg. Co. He formerly was production manager of the Briggs plant at Dagenham, England.

Kenneth C. Plasterer has been appointed general manager of the new General Motors Forge Plant at Lansing, succeeding George Motherwell, resigned. He comes from the Olds Motor Works.

Starting as a sales representative of the Norwalk Tire & Rubber Co., Norwalk, Conn., in 1924, **A. A. Hall** recently became its manager of sales.

E. Bryan Williams, formerly chief traffic engineer of the St. Louis Public Service Co., and **Philip M. Nigro,** until recently a mathematics professor at Loyola College, Montreal, have joined the laboratory staff of the Torrington Mfg. Co., Torrington, Conn., as research engineers.

Philip Handerson has been named sales promotion and advertising manager of the Ferguson-Sherman Mfg. Co., Dearborn, Mich., distributor for Ford tractors. He formerly was director of advertising and publicity for B. F. Goodrich Co. and director of research in the Cleveland office of McCann-Erickson, Inc.

M. W. Rogers, formerly general factory manager in charge of production at the Caterpillar Tractor Co., has been elected president of the Davis & Thompson Co. and the Universal Power Shovel Corp., Milwaukee, and also of the Potts Machine Co., Jackson, Mich.

New Truck Registrations

	December 1940	November 1940	December 1939	12 MONTHS 1940	12 MONTHS 1939	Per Cent Change, 12 Months 1940 over 1939	Per Cent of Total Twelve Months 1940	Per Cent of Total Twelve Months 1939
Chevrolet	19,119	15,990	13,713	194,018	169,457	+ 14.6	33.67	34.81
Ford	14,781	14,264	11,532	162,330	123,889	+ 26.2	28.17	26.48
International	5,646	5,335	4,933	77,891	66,048	+ 18.0	13.52	13.57
Dodge	4,182	3,995	1,860	54,615	48,049	+ 13.9	9.48	9.87
G. M. C.	3,477	3,356	2,771	42,486	34,908	+ 21.6	7.37	7.17
Plymouth	769	627	309	9,573	8,294	+ 15.5	1.66	1.70
Mack	630	760	508	7,754	6,670	+ 16.1	1.34	1.37
White	901	839	287	7,344	4,558	+ 61.0	1.27	.94
Diamond T	408	459	503	6,358	5,412	+ 17.4	1.10	1.11
Willys-Overland	107	121	174	2,291	1,634	+ 40.0	.40	.34
Autocar	149	156	106	1,955	2,044	- 4.5	.34	.42
Brockway	135	171	121	1,672	1,815	- 7.8	.29	.37
Divco	162	87	149	1,662	1,481	+ 12.1	.23	.30
Federal	134	121	202	1,617	1,837	- 12.0	.23	.38
Studebaker	122	45	86	1,207	2,110	- 43.0	.21	.43
Hudson	75	62	38	761	409	+ 86.3	.13	.08
Reo	94	103	8	625	853	- 26.7	.11	.18
Sterling	28	37	18	341	326	+ 4.8	.06	.07
Bantam	4	4	37	335	590	- 43.2	.06	.12
F. W. D.	15	14	16	252	182	+ 38.4	.04	.04
Miscellaneous	157	72	84	1,217	1,182	+ 3.0	.21	.25
Total	51,095	46,618	37,460	576,304	436,748	+ 18.4	100.00	100.00

Ethyl Gasoline Corp. has named **John G. Matin,** former national director of the Ethyl motor clinic system and **Richard C. Murphy,** former manager of its New York division, eastern and western regional managers, respectively.

William C. Boulcott is now manager of the Green Island, N. Y., branch of the Ford Motor Co. He was assistant manager of the Ford Twin City branch at St. Paul.

Standard Products Co. has retained **George W. Walker,** Detroit, as consulting engineer on new automobile trims and accessories.

James H. Deaderick, who has been assistant sales manager of the western sales division of the Caterpillar Tractor Co. since 1939, has been appointed assistant general parts manager at the home office in Peoria, Ill.

H. B. Rose, assistant superintendent of the International Harvester Co. Farmall works, Rock Island, Ill., has been transferred to Indianapolis as superintendent of the company's International motor truck engine works. He has been succeeded at Rock Island by **Paul W. Johnson,** formerly his assistant.

George N. Jeppson has been elected president of Norton Co., Worcester, Mass., succeeding **Aldus C. Higgins,** who resigned to become chairman of the board.

L. A. Mullen has been made manager of sales of tubular products for the Pittsburgh Steel Co.

Acme Steel Co., Chicago, announces the appointment of **Guy T. Avery** as works manager of its Riverdale plant.

Walter E. Marble, veteran sales representative for the D. A. Stuart Oil Co., Chicago, recently passed the half century mark in the service of the company and was honored at a gathering of his co-workers.

R. H. Hathaway, formerly sales engineer for the Production Machinery Co., Greenfield, Mass., has been appointed assistant to the chief engineer of Hammond Machinery Builders, Inc., Kalamazoo, Mich.

William C. Yates, since 1937 manager of the control and renewal parts division of the General Electric's industrial department, has been appointed an assistant manager of that department. He will continue to have charge of the industrial control and renewal parts division.

Marion P. Crews, for nine years an aviation engineering official in Government agencies and for the past two years chief of the Civil Aeronautics Administration midwest aircraft airworthiness section at Kansas City, has been appointed to chief of the CAA airworthiness section, bureau of safety regulation, in Washington.

(Turn to Next Page, Please)

New Passenger Car Registrations

	December 1940	November 1940	December 1939	TWELVE MONTHS 1940	TWELVE MONTHS 1939	Per Cent Change, 12 Months, 1940 over 1939	Per Cent of Total Twelve Months 1940	Per Cent of Total Twelve Months 1939	THREE MONTHS MODEL YEAR 1940	THREE MONTHS MODEL YEAR 1939	THREE MONTHS MODEL YEAR Per Cent Change
Chevrolet	88,195	72,011	64,819	853,529	598,341	+ 42.7	25.00	22.55	231,895	149,585	+ 55.0
Ford	52,810	48,412	45,285	542,755	481,496	+ 12.8	15.90	18.15	142,983	125,790	+ 13.8
Plymouth	37,621	37,452	16,875	440,093	348,807	+ 26.0	12.88	13.15	116,590	66,213	+ 76.0
Buick	28,758	27,951	24,585	295,513	218,995	+ 34.8	8.65	8.25	88,992	74,970	+ 18.8
Pontiac	25,143	23,817	18,508	235,815	159,836	+ 47.5	6.90	6.02	71,536	50,429	+ 42.0
Oldsmobile	21,740	19,887	16,737	201,256	146,412	+ 37.1	5.89	5.52	60,254	46,765	+ 29.0
Dodge	17,584	15,785	9,776	197,252	176,585	+ 11.8	5.77	6.66	43,642	27,119	+ 61.0
Studebaker	8,747	8,057	8,422	102,281	84,660	+ 20.9	2.99	3.19	26,917	25,739	+ 4.8
Chrysler	11,421	9,702	3,894	100,117	63,956	+ 56.8	2.93	2.41	27,609	12,061	+130.0
Mercury	7,840	6,996	7,468	80,418	65,884	+ 22.2	2.35	2.48	19,595	18,450	+ 6.1
Hudson	6,227	6,058	7,671	79,979	62,855	+ 27.4	2.34	2.37	20,329	24,582	- 17.2
Packard	5,678	5,813	6,858	73,794	62,005	+ 19.0	2.16	2.34	18,537	23,113	- 19.8
De Soto	6,997	6,102	2,914	71,943	51,951	+ 38.7	2.11	1.96	17,919	9,660	+ 85.7
Nash	6,164	4,427	4,777	52,853	54,050	- 2.2	1.55	2.04	13,125	13,904	- 5.7
Cadillac	5,232	4,391	1,479	21,965	13,090	+ 68.0	.64	.49	13,213	3,706	+257.0
Willys	1,645	1,783	1,817	21,418	14,734	+ 46.0	.63	.55	4,846	5,788	- 16.3
Lincoln	1,817	1,787	2,123	21,004	19,940	+ 5.3	.61	.75	5,463	5,297	+ 3.2
La Salle	128	157	2,466	16,599	22,197	- 25.0	.49	.84	666	6,743	- 90.2
Graham	150	180	48	1,856	3,660	- 49.3	.05	.14	531	250	+112.0
Bantam	26	29		800			.02		99		
Crosley	32	31		432			.01		111		
Hupmobile	32	46	7	211	907	- 76.7	.13	.03	118	40	+195.0
Miscellaneous	86	556	155	4,022	3,016	+ 33.4	.13	.11	1,028	497	+106.5
Total	334,073	301,430	246,544	3,415,905	2,653,377	+ 29.0	100.00	100.00	925,998	690,701	+ 34.2
Chrysler Corp.	73,623	69,041	33,259	809,405	641,299	+ 26.0	23.70	24.17	205,760	115,053	+ 78.5
Ford Motors Corp.	62,467	57,195	54,876	644,177	567,320	+ 13.3	18.86	21.38	168,041	149,537	+ 12.3
General Motors Corp.	169,196	148,214	128,654	1,624,677	1,158,871	+ 40.2	47.56	43.68	466,556	332,198	+ 40.5
All Others	28,787	26,980	29,755	337,646	285,887	+ 18.4	9.88	10.77	85,641	93,913	- 8.7

MEN

(*Continued from page* 187)

Harold D. Wright, traffic supervisor for the Dodge main plant at Detroit, is the new president of the Motor City Traffic Club.

C. M. Kaltwasser has been appointed general manager of the Stinson Aircraft Division of Vultee Aircraft, Inc., at Wayne, Mich. He previously was president and general manager of Marvel-Schebler Carburetor Co. at Flint and at one time was vice president of Timken-Detroit Axle Co

Frank Holman, formerly brake engineer with the Autocar Co., Ardmore, Pa., has joined the staff of the Bendix Products Division of the Bendix Aviation Corporation as sales engineer in the eastern territory for B-K vacuum power brakes.

PUBLICATIONS

(*Continued from page* 185)

Acme Steel Company's current issue of Acme Process News pictures a number of interesting applications of **Steelstrap** to shipments, which should be helpful to manufacturers and exporters seeking to speed up packing and shipping operations. Included are illustrations and articles on strapping practices employed by shippers of trucks, airplanes, boats, and other products.*

Ampco Metal, Inc., has a new **safety tool** folder, describing and illustrating its nonsparking safety tools.*

The Atlantic Gear Works has a new general catalog on **stock gears, sprockets and chains, reducers, bearings and couplings.** A special supplement has been attached listing the types of equipment that Atlantic Gear Works now has available for special work.*

Performance Data Sheets Nos. 66, 67, 68 and 69 by Gisholt Machine Co. These sheets explain how the production of Diesel engine fuel injector bodies, garage equipment parts, collets and tractor steering-clutch-drums was speeded up on turret and automatic lathes.*

National Broach & Machine Co. has issued a folder on **Red Ring Gear Lapping,** which contains a summary of lapping methods.*

Cleveland Tramrail Division of The Cleveland Crane & Eng. Co. has prepared a booklet for those interested in the **overhead method of materials handling.** The booklet features a variety of **grabs and handling devices** for many kinds of materials.*

Opportunities for Technically Trained Men in the Business Battle Ahead is the title of booklet by Alfred Kauffmann, president of Link-Belt Co.*

Bakelite Molding Plastics is the title of a new booklet issued by the Bakelite Corp. The booklet is illustrated and contains descriptions of **compression and injection molding processes** and explains the essential differences between thermosetting (hot-set) and thermoplastic (cold-set) molding materials. The physical, mechanical and electrical properties and characteristics of "Bakelite" phenolics, ureas, polystyrenes and acetates are enumerated in text and tables so as to give the reader an understanding of how these materials can be employed.*

The new line of **Reznor gas-fired unit heaters,** which includes fan-type, blower-type and duct-type units, is described in Catalog U41 recently issued by the Reznor Manufacturing Co.

A catalog, devoted entirely to the new **80-horsepower Diesel D7 tractor,** has just been issued by Caterpillar Tractor Co. The catalog is profusely illustrated and separate sections of the book are devoted to the fuel system, general engine construction features, the lubricating system, the transmission and final drive, the tracks and track roller assemblies, operator comfort, and available allied equipment.*

* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Monthly Motor Vehicle Production

(U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1940	1939	1940	1939	1940	1939
January	375,476	292,869	74,016	64,093	449,492	356,962
February	350,535	253,914	71,690	63,606	422,225	317,520
March	364,947	312,392	75,285	77,107	440,232	389,499
April	375,626	286,200	76,807	68,066	452,433	354,266
May	338,353	249,455	74,139	63,793	412,492	313,248
June	294,779	257,289	67,787	66,964	362,566	324,253
July	172,166	155,850	74,005	62,750	246,171	218,600
August	48,333	62,475	41,533	40,868	89,866	103,343
September	227,880	165,119	56,703	27,560	284,583	192,679
October	428,270	259,610	86,104	65,079	514,374	324,689
November	417,905	295,134	93,068	73,407	510,973	368,541
December	403,184	384,858	98,747	84,260	506,931	469,118
Total	3,802,454	2,975,165	889,884	757,553	4,692,338	3,732,718

AMA Adopts Gross Weight For Truck Rating Basis

A new plan for rating motor trucks on the basis of gross vehicle weight rather than on nominal tonnage has been adopted by the motor truck committee of the Automobile Manufacturers Association and will be recommended for use by all truck manufacturers.

Decision to utilize gross vehicle weight, in lieu of the outmoded nominal tonnage rating which was intended to indicate the load capacity, was reached after months of study and after consultation with the motor truck rating committee of the Society of Automotive Engineers.

Under the A.M.A.'s recommendations, complicated formulas will be avoided and truck manufacturers will be expected to rate their own vehicles based upon engineering factors of the component parts. An identification plate for each vehicle is recommended, which would include at least the following minimum information:

Manufacturer's name, address, model, chassis number, certified net horsepower at specified r.p.m. and maximum gross vehicle weight in pounds. Many individual manufacturers are expected to elect to put on still further information.

Design Problems in Aircraft Electrical Equipment

(*Continued from page* 164)

get exceedingly hot. There is also likely to be a good deal of trouble from arcing or flashing at the commutator, especially in the ionized air of the higher regions of the atmosphere. The lower the pressure of the atmosphere the less its dielectric strength. Besides, as one of the speakers put it, "in order to get down the weight of the machines we take out iron and copper and substitute an air-blast," and with the comparatively weak magnetic field and high current density in the armature conductors, considerable armature distortion takes place, which makes for poor commutation.

Commutation difficulties are avoided when alternating current is used, and that seems to be the chief reason why consideration has been given to A.C. equipment — both single-phase and three-phase. However, alternating-current equipment also is somewhat lighter and causes less trouble from radio interference. When alternating current is to be used, the question of the most desirable frequency arises. Owing to the high speeds at which the machines must be operated in order to get high output per unit of weight, frequencies far higher than the commercial 60 cycles per sec. are required. The Air Corps at present seems to favor 400 cycles per sec., which corresponds to an armature speed of 24,000 r.p.m. for a two-pole machine. For certain applications of alternating current on the plane, a substantially constant frequency is desirable, and this cannot be had if generators are driven positively from the main engines. Mr. Holliday expressed the view that alternating-current equipment would become practical for aircraft only after an infinitely variable drive gear had been developed, with a speed range of at least 1:2. Such a drive gear, of course, also must be light and reliable.

When outputs of as high as 30 kw. are required, the use of such low voltages as 30 are no longer practical, and the opinion was expressed that 110 volts would probably be adopted as standard. Of course, the higher the voltage the more difficult it becomes to use a storage battery as a standby source of current, because the specific weight of the battery increases with the number of cells. On the other hand, the weight of the cables required decreases rapidly as the voltage is increased. This was substantiated by figures given for a certain four-engined plane in which there are no less than 962 pieces of cable, of a total length of 10,892 ft. or more than two miles. If a voltage of 110 were used on this plane

the cables would weigh 60.8 lb. whereas if 12 volts were used the weight would be 243 lb.

Commutation difficulties with direct-current machines increase with the output and the altitude. In large stationary D.C. generators, so-called interpoles are used to facilitate commutation, but in aircraft generators it is practically impossible to find room for them. It was also suggested that compensating windings could be used on the field poles, in slots therein. These are series windings and would be designed to give the proper magnetizing effect to completely compensate for the cross-magnetizing effect of the armature current, thus rendering interpoles unnecessary. An objection raised to such compensating windings was that they would practically duplicate the C-R loss of the armature. Even without such windings the internal losses are quite high, for in order to bring the weight down, efficiency must be sacrificed.

An engineer from an aircraft-operating company pointed out that while aircraft generators usually had provision for forced ventilation, the ventilating passages often were so arranged that they offered abnormal resistance to air flow, and sometimes the air current did not hit the commutator at all, where the cooling effect was most necessary. In a certain case, where considerable trouble from overheating occurred, when the ventilating passages were changed so the air stream hit the commutator directly, there was no further trouble from commutator leads coming loose.

Automotive Materials

(*Continued from page* 175)

tion presented the most difficult problem. But by taking advantage of some of the new developments in synthetic resins, the increased structural strength resulting from combining farm grown fibers with them, and by redesigning the molds and presses, he believes the problem to be near solution.

Develop Flexseal Airplane Windows

FLEXSEAL, a new type of window pane combining safety glass and a plastic frame, is a recent development of the Pittsburgh Plate Glass Co., of Pittsburgh, Pa. It was intended initially for use on substratosphere airplanes, whose pressurized cabins require strong and tightly sealed windows, which, if broken, will not leave the frame or release the cabin pressure. Because of its unique properties and many possible variations, Flexseal may be used to advantage in other applications.

Like ordinary safety glass, it is laminated with one or more thick layers

War machines and munitions have to be good to stand up under war conditions. They must be made rapidly in huge quantities by a variety of plants. All parts must be strictly interchangeable.

Hence the task of guarding quality becomes a matter of life and death importance to a nation rearming to preserve its liberty.

Sheffield Visual Gages are stalwart guardians of dimensional quality. They are used in checking dimensions of manufactured and purchased parts, tools, production and master gages.

The sturdy Reed Mechanism, combined with the light beam lever arm, provides a sensitivity to meet the highest precision standards of measurement—but without the delicate fragility so often associated with sensitivity.

These gages are not delicate, they are strong and deadly accurate. They are made in various models to check accurately to thousandths, "tenths" or millionths of an inch and all provide rapid, easy gaging to any limits required on production work.

Write for information.

SHEFFIELD
GAGE CORPORATION • DAYTON, OHIO, U.S.A.
MASTER GAGEMAKERS

of plastic between sheets of glass, but in addition the plastic extends beyond the edges of the glass to serve as a flexible, rubber-like frame that can be bolted, screwed or nailed to the window sash. By using the flexible frame, the glass is not affected by localized stresses. In case the glass is broken, the thick plastic layer serves as an air-tight diaphragm to maintain the inside and outside air pressure differential. (*See illustration on page* 175.)

Engine Mounting for Seagoing Aircraft

HARRIS PRODUCTS CO., Detroit, has introduced a new line of Torflex engine and cowl mountings having a high capacity load rating. They are made of two well-known materials—Neoprene for resistance to oil and ozonal attack at high altitudes and stainless steel for resistance to the corrosive effects of salt air at low altitudes. While originally designed for aircraft use, these mountings are adaptable for industrial applications where operating conditions require both Neoprene and stainless steel. (*See illustration on page* 175.)

The method of manufacture provides a mechanical bond between the two materials. Capacity rating with axial load is approximately 150 lb. per sq. in. The process permits the manufacture of special sizes.

The Making of Reduction Gears at Wright Aircraft

(*Continued from page* 155)

ing has been found to be the most economical method of finishing. Furthermore, it has been found that modern gear-grinding machinery enables semi-skilled operators to produce gears efficiently within the established tolerances.

Today, at the Wright plant, about 80 per cent of the spur gears, 20 per cent of the external splines, 10 per cent of all involute internal splines, and 40 per cent of the external square splines are ground.

The evolution from earlier practices to today's methods has been remarkably rapid, considering the fact that until the past few months the orders for any given type of engine were relatively small. Had it not been for the far-sighted management of our leading aircraft-engine manufacturers, who appropriated large sums of money and production engineering time to prepare for producing these units on a mass-production scale, every American would have a great deal of cause for alarm these days.

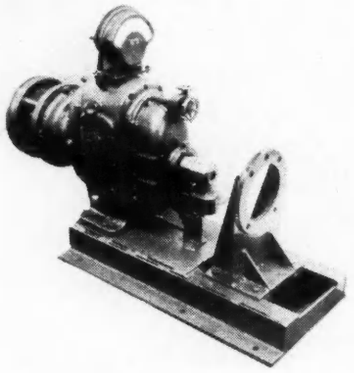
The production engineering department of Wright Aeronautical Corp. is playing—and has been playing—an all-important part in giving America line production of high output aircraft engines in the interest of national defense.

MEN and MACHINES

(*Continued from page* 173)

System A delivers fluid over a loop no longer than 200 ft., with a minimum internal diameter of ½ in. With System B the loop can be as long as 450 ft., with a minimum internal diameter of ¾ in. With System C the fluid is recirculated through the head of each gun. Piping should be limited to a minimum internal diameter of ½ in. and a maximum length of 200 ft.

A FULLY enclosed variable speed test rig combining the basic P.I.V. transmission unit and an adjustable mounting bracket on a rigid steel base is being manufactured by the Link-Belt Co., Chicago. It is called the Link-Belt P.I.V. Gear Test Rig and is designed for testing generators, magnetos, governors, vibrators, pumps, springs, bearings and other special equipment. It can be used for calibration purposes or for determining whether the equipment runs true, functions efficiently, and carries the load properly.



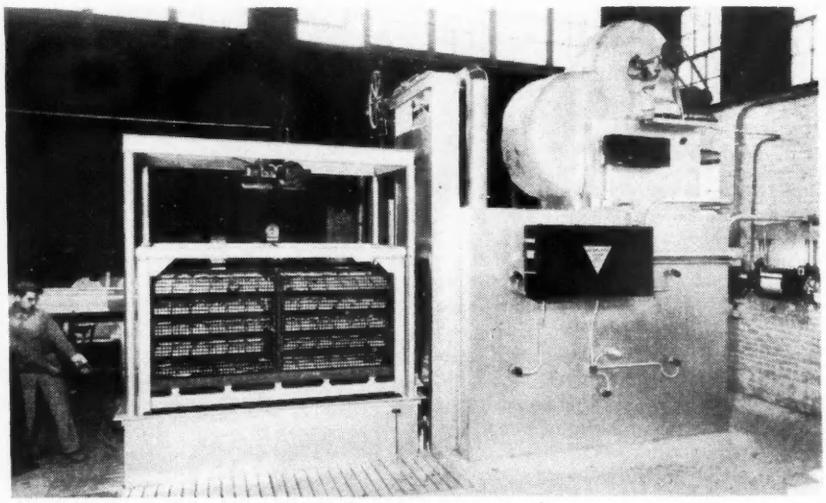
Link-Belt P.I.V. Gear Test Rig.

THE MILBURN COMPANY, Detroit, has a new production known as PLY No. 9 for the use of operatives in industries where perspiration of the hands is injurious to both workers and products. It is said to be particularly useful in plants devoted to the manufacture of antifriction bearings and other aircraft parts on which normal perspiration causes rust spots. Users of new synthetic finishes also are said to have found it helpful because it eliminates the irritations that cause industrial skin disorders.

PLY is a water-like colorless solution. The worker dips his hands in it and allows the solution to dry. As it dries it forms a fine invisible film that affords protection to both the hands and the product.

A RECENTLY developed product of the Despatch Oven Co., Minneapolis, Minn., is a furnace for the heat treatment of aluminum and magnesium alloys to improve their tensile strength and other physical properties. The unit is equipped with an electric heating system, but can also be fitted with a gas heating system. The heat distributing ducts and air circulation system are especially adapted for the heat treatment of non-ferrous metals. By equipping it with oversized, high static pressure fans, interior heat uniformity is said to be maintained at plus of minus five degrees when operating at 950 degrees Fahr. Air velocity through the furnace exceeds 20 m.p.h. so as to assure rapid, uniform heat treatment. Safety switches are provided to prevent damage to the material.

Adjoining the furnace is a quench tank and elevator system, which expedites quenching of the parts.



Despatch heat treating unit for aluminum and magnesium alloys.

ACOUSTIC gages giving bell or buzzer signals are reported to have been developed by the Junkers aircraft works at Dessau, Germany, according to a statement issued by the Machinery Division. Department of Commerce. For years, it is said, the Junkers organization has done much to foster the employment of blind skilled labor. The new type of gage makes possible the employment of blind persons in inspection work on machine parts on which there are tolerances ranging from 1/100 to 1/1000 mm. Piston- or membrane-type gages are employed, according to the diameter of the parts to be inspected. The piston or membrane forces mercury up into two capillary tubes, causing it to close an electric circuit that operates the signaling device. If the bell or buzzer sounds it means that the piece is not within the limits set and must be reprocessed or rejected. It is claimed that the operative can judge the accuracy of the piece inspected also by the pitch of the acoustic signal.

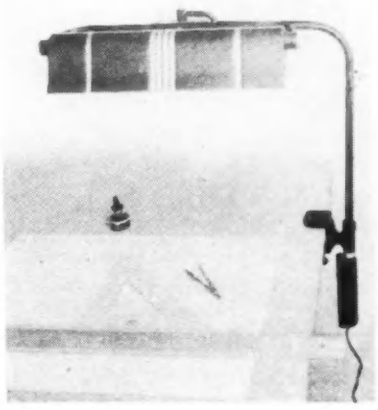
GREATER accuracy is a feature claimed for the new 8667 Temperature Indicator announced by Leeds & Northrup Co., Philadelphia, manufacturers of electrical measuring instruments, heat treating furnaces and automatic controls. Completely self-contained, this new potentiometer is made light and compact to meet the need of a portable instrument for checking thermocouples and measuring temperatures. Built into it are coarse and fine battery rheostats, pointer galvanometer, standard cell,

New Temperature Indicator offered by Leeds & Northrup.

battery, galvanometer key and standardizing key. Improved accuracy has been attained by calibrating only a small portion of the range on a continuously adjustable slidewire. The remainder, adjustable in fixed steps, is on a dial switch of 10 highly accurate resistors. The range is from zero to 111 millivolts with a limit of error of plus or minus .1 millivolt.

FREDERICK POST CO., Chicago, announces as a new product, the Engineers Fluorescent Lite, which has

Engineers Fluorescent Lite of Frederick Post Co.



been designed particularly for use in the drafting and designing divisions of engineering departments. Besides the ordinary advantages of fluorescent lighting, this light is designed to tone down the blue cast often found in fluorescent lighting so as to give neutral, colorless illumination. A special pigment-treated reflector eliminates the blue tone. The lamp shade and holder are attractively finished in brown with silver trim. It can be adjusted to various positions.

For 80% OF ALL TURNING, FACING, BORING JOBS

For simplified carbide grade selection and instant identification Carboloy STANDARD tools for STEEL cutting are copper colored and, for cast iron, brass, etc. aluminum colored.

Designed for "universal" use on 80% of all turning, boring and facing applications Carboloy standard tools comprise but five styles in three grades—grade 78-B for general purpose use on steel, grades 44-A and 883 (for extra long life in rigid machines) on cast iron, etc.

These new standards are easy to select and easy to use. Each tool comes to you ground and ready for use. Chip breaking, too, has been simplified. Each steel cutting tool, styles 4, 7, 13 and 14, is supplied with a "universal" chip breaker already ground in. With each tool is packed a vest-pocket size operators' instruction booklet with complete, condensed operating and maintenance data.

For wider, more profitable use, maximum economy, easy ordering, simplified stocks and FAST deliveries—use Carboloy STANDARD tools. Write for catalog GT-125.

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STANDARD TOOLS

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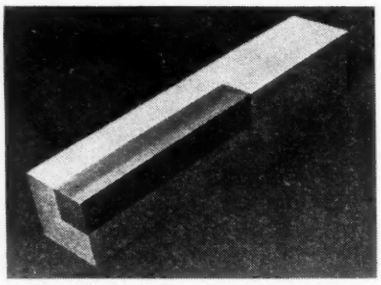
CARBOLOY STANDARD TOOLS For "Universal" Use

Style No. 4, Right Hand—No. 7, Left Hand. Available in 9 sizes.
Style No. 13, Right Hand—No. 14, Left Hand. Available in 5 sizes.
Style No. 1—Available in 9 sizes.
Steel Cutting Tools Styles 4, 7, 13, 14 have ground-in chip breaker as illustrated



Fansteel Tantung "G" economy cutting tool.

A NEW general purpose grade of hard cutting alloy known as Tantung "G" has been developed by the Fansteel Metallurgical Corp., North Chicago, Ill. This metal, composed of tungsten and tantalum in a matrix of cobalt and chromium is intended for machining steel as well as cast iron, brass, aluminum and other materials.

Tantung "G" is obtainable in solid tool bits for use in tool holders and also in the form of economy tools, the bits of which are securely brazed to recessed tool shanks approximately twice the cross section and length dimensions of the Tantung bit. This construction conserves the valuable cutting alloy and at the same time adds strength and support. The economy tool is designed to permit either right or left hand cutting.

A HONING machine known as the Empco has been placed in production by the Enterprise Machine Parts Corporation, Detroit. Being of the horizontal type (which is said to permit more efficient action of the coolant), the machine can accommodate work from 2 to 12 in. in diameter and requiring strokes up to 57 in. It is claimed to produce perfectly round, straight holes with a mirror finish, and to correct tapers and out-of-roundness.

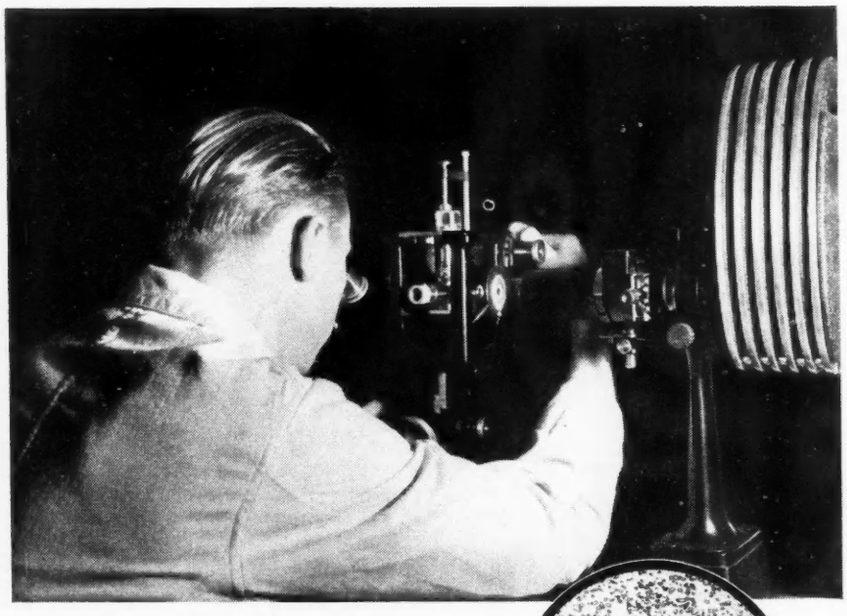
All controls are mechanically operated and the honing tool is withdrawn by means of a conveniently-located hand wheel. Spindle speeds range from 50 to 200 r.p.m., in seven steps. The spindles run in anti-friction bearings.

H & G SPECTIFIER is the name of the inspection apparatus that has been placed on the market by the Eastern Machine Screw Corp., New Haven, Conn. This device provides a convenient and high speed method of inspecting the finish and other details of screw machine parts and similar work up to three inches in diameter.

H & G Specifier for visual inspection of screw machine parts.

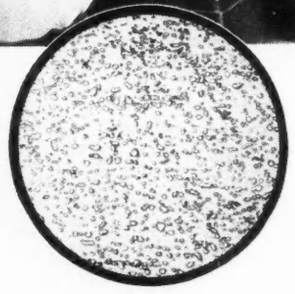
It is equipped with wide diameter lens so that both eyes can be used at the same time in making a critical inspection at various angles. The light source was selected so as to assure a highly efficient and uniform degree of illumination.

A NEW end-mill grinding fixture produced by Roan Manufacturing Co., Racine, Wis., weighing 8 lb. and measuring 5 by 7 in., is claimed to make it possible to grind an end mill in five minutes. Its grinding wheel may be slipped into the chuck of any high-speed drill press. The fixture, which takes mills up to 1 in. shank diameter, has a movable V-block with a ⅜-in. movement, regulated by a fine-thread thumb screw for delicate adjustment. Both a bottom stop and a spring-finger



THOMASTRIP, Always Laboratory Approved

Making examinations and pictorial records of microstructures are some of the important steps in the laboratory approval of Thomastrip. This metallurgical investigation enables us to control the steel structure which is very important to your requirements of hardness, stiffness, surface, and heat treating quality. Furthermore, laboratory inspection of this nature provides a dependability for duplicating your specifications, and often brings to attention worth-while improvements. As a result, manufacturers have often decreased their production costs. Perhaps laboratory approved Thomastrip will reduce yours.



Pictorial records, such as the one above, are preserved to aid in the duplication of our customers' requirements.

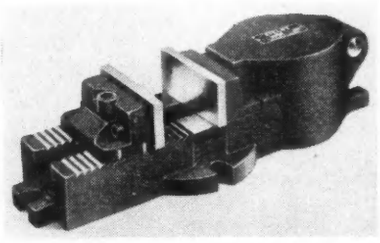
Thomas Strip
COLD ROLLED STRIP STEEL

BRIGHT FINISH UNCOATED, AND ELECTRO COATED WITH NICKEL, ZINC, COPPER, BRASS

THE THOMAS STEEL CO.
SPECIALIZED PRODUCERS OF COLD ROLLED STRIP STEEL
WARREN, OHIO

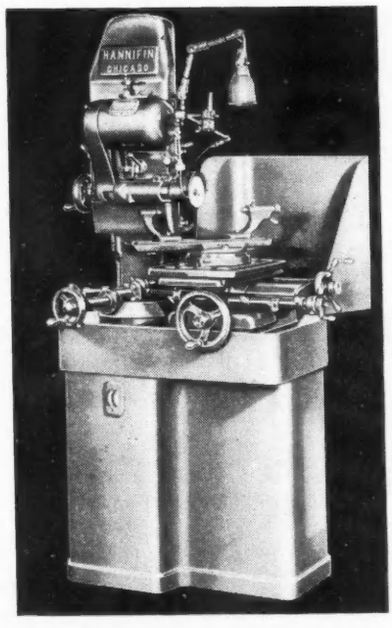
stop are fixed to the block. In addition, the fixture is equipped with a leveling screw which enables the operator to grind a straight face on an end mill.

AIRLOX is the trade name of the pneumatic vises that have been introduced by Production Devices, Inc., East Hartford, Conn., in which are combined the quick action of air and the pressure grip of a screw vise. This production tool was developed to increase the output in milling, planing, shaping, drilling, tapping, and assembling operations as well as bench work. The overall size of the standard model is seven by 20 inches. The jaw width is five inches and its depth 2¼ inches. The maximum air consumption per operation is given as .02 cu. ft.



Airlox pneumatic vise.

DESIGNED for tool grinding operations on modern cutting tools, the No. 5 Universal Precision Tool Grinder is a new product of the Hannifin Mfg. Co., Chicago. The grinding wheel spindle is built for either dry or wet grinding and is driven by a ¾ hp. universal motor. Interchangeable pulleys permit ten spindle speeds ranging from 3600 r.p.m. to 35,000 r.p.m. under load. The spindle carriage and table slides are operated manually with both rapid traverse and micrometer feed. A separate motor drives the coolant pump. Included in the regular equipment are two center supports and locating finger, a subtable and plain angle wheel dresser.



Hannifin No. 5 Universal Precision Tool Grinder

GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has redesigned its ignitron tubes for resistance-welder control. These tubes now have both inner and outer jackets of stainless steel and are said to be completely corrosion-resistant. The tubes are particularly adapted to welder control service, because of their ability to carry very high peak currents for short periods.

RECOGNIZING the need for faster and more efficient moving of materials and parts in factories and warehouses, the Continental-Diamond Fibre Co., Newark, Del., has redesigned and recatalogued its line of hollow ware, consisting of boxes, trucks, cans, barrels, baskets and trays. The purpose is to provide greater standardization and at the same time sufficient flexibility so that standard equipment can be modified readily to meet individual handling problems, yet not penalize the buyer in the way of price for slight deviations from standard specifications. The new catalog is in the form of a

Cast Bronze BEARINGS for Long Life

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handbook and is published under the title, Diamond Vulcanized Fibre Hollow Ware.

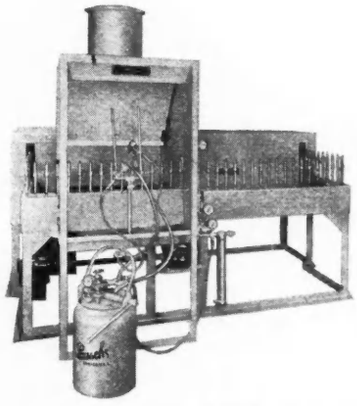
A HACK saw blade with a double cutting edge is the new development of Miller Falls Co., Greenfield, Mass. Teeth along the first cutting edge are set fractionally wider than along the second edge thus eliminating drag and wear that was formerly an obstacle to this type of design. Guaranteed shatterproof, breakage is minimized by giving the blade a special heat treatment that hardens the teeth, but leaves the center and ends soft.

Miller Falls hack saw blade with double cutting edge.

SIMPLICITY of design and greater operating usefulness are embodied in a new printer announced by Charles Bruning Co., New York. Known as the Model "55" BW Printer, this machine was designed with compactness as a major consideration. It is 32 inches wide, 62 inches long, and 48 inches high.

The new model is a 42-inch printer and operates with either cut sheets or roll stock. Ink tracings can be printed at a speed of 12 to 15 feet per minute. Equipment includes a 55-watt mercury vapor quartz lamp, which is guaranteed for 1000 hours, and a double centrifugal blower to reduce operating noise. All bearings are the ball bearing type.

AN AUTOMATIC airfinishing and drying unit for application of black paint to 20 mm. shells is one of the installations for coating shells of various sizes that is being built by the Paasche Airbrush Co., Chicago, in connection with the defense program. It has a capacity of 17,000 shells for an eight-hour day. The unit is equipped with a steel roller chain, 164 revolving spindle assemblies, automatic off and on control for air brushes, and a variable speed pulley and reducer to operate the chain at speeds of four to nine feet per minute.



Paasche automatic coating unit

PAINTING of projectiles from 37 mm. to 155 mm. is handled automatically in a special machine being built by the Eclipse Air Brush Co., Inc., Newark, N. J. The rate of operation is 500 projectiles an hour when spraying six-minute lacquer. The machine consists of a seven-foot indexed turntable with 36 rotating spindles carrying the shells in front of automatic spray guns that are synchronized with the turntable. After being sprayed, the projectiles pass through a drying oven mounted on the table opposite the spray guns.

PYLE-NATIONAL CO., Chicago, Ill., has added a new line of heavy duty plugs, receptacles and cord connectors for use with portable electrical equipment. They have the same electrical rating and are approximately the same size as the standard attachment plugs and receptacles, but also embody the heavy duty design and substantial construction features of the larger Pyle-National Triploc plugs and receptacles for industrial use.

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Assembling time reduced to 50% and more . . . spoilage and injuries eliminated! These are the highly profitable features that have made HOLTITE-Phillips screws, bolts and allied fastenings the choice of progressive manufacturers who have adopted faster driving methods to speed deliveries and cut costs. • • Regular HOLTITE products, and Specials, offer every user an unlimited range of fastenings that can be profitably used in the assembly of practically every manufactured product.
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